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United States
Department of
Agriculture

Forest Service
Southern Region

Final Environmental Impact Statement

# VEGETATION MANAGEMENT in the Appalachian Mountains

## APPENDICES VOLUME II

Management Bulletin R8-MB 38

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## COMMENTS ON THE METRIC SYSTEM

The metric system is used to describe weights and measures. It is a decimal system -- units are consistantly named to reflect multiplication or division of the basic unit by some power of 10 (10, 100, 1000, etc.). The two basic defined units of this system are the meter and the kilogram. All other units (volume, area, etc.) are calculated based on these two.

Metric measurement is the standard for scientific communication worldwide. It has been selected in preference to many other systems including the English system of measures which is in common use in the United States. Below is a table which will help readers of this Risk Assessment understand the metric numbers presented throughout the text.

### ABBREVIATIONS
(Metric and English)

| | | |
|---|---|---|
| ac = acre | kg = kilogram | ml = milliliter |
| cc = cubic centimeter | km = kilometer | mm = millimeter |
| cm = centimeter | l = liter | ppm = parts per million |
| ft = foot | lb = pound | |
| g = gram | m = meter | oz = ounce |
| ha = hectare | mg = milligram | qt = quart |
| in = inch | mi = mile | um = micrometer |

### CONVERSIONS

Length:

| METRIC to ENGLISH | | ENGLISH to METRIC |
|---|---|---|
| 1 km (1,000 m) == 0.6214 mi | | 1 mi == 1.609 km |
| 1 m == 39.37 in | | 1 ft == 0.305 m |
| 1 cm (.01m) == 0.394 in | | 1 in == 2.54 cm |
| 1 mm (.001m) == 0.0394 in | | |
| 1 um (.000001m) == 0.000039 in | | |

Mass / Weight:

| | |
|---|---|
| 1 kg (1,000 g) == 2.2046 lb | 1 lb == 453.592 g |
| 1 g == 0.035 oz | 1 oz == 28.35 g |
| 1 mg (.001 g) == 0.000035 oz | |
| 1 ug (.000001 g) = 0.000000035 oz | |

Others:

| | |
|---|---|
| 1 l == 1.056 qt (liquid) | 1 qt == 1.136 l |
| 1 ha == 2.471 ac | 1 ac == 0.40 ha |
| 1 kg/ha == 0.89 lb/ac | 1 lb/ac == 1.12 kg/ha |

APPENDIX A

# Risk Assessment

# SUPPLEMENT TO APPENDIX A

## FINAL RISK ASSESSMENT FOR THE USE OF HERBICIDES IN THE SOUTHERN REGION USDA FOREST SERVICE

Appendix A in the Draft EIS (the Risk Assessment for the Use of Herbicides in the Southern Region, USDA Forest Service) was not significantly changed based on public comment. It is not reproduced in full in this Final EIS.

Two changes are noted as Supplements to be added to the Draft Appendix.

Supplement No. 1 presents a newly prepared review of mineral oils proposed for use as a substitute for diesel oil in field application.

Supplement No. 2 presents pages edited as a result of the addition of two newly EPA-approved studies on tebuthiuron. These pages were edited and then reproduced in their final form. They replace the previously published pages in the Draft Risk Assessment.

Copies of appendix A in its entirety are filed in the Process Records.

SUPPLEMENT No. 1

# MINERAL OILS:
# A REVIEW OF THEIR TOXIC PROPERTIES AND ENVIRONMENTAL FATE CHARACTERISTICS

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TABLE OF CONTENTS


INTRODUCTION . . . . . 1

SECTION 1. CHEMICAL AND PHYSICAL PROPERTIES OF MINERAL OILS . . . . . 1

SECTION 2. TOXICITY OF MINERAL OILS 3

Toxicity Summary of Mineral Oils . . . . . 3

Mineral Oils Toxicity in Humans . . . . . 4

General Toxic Effects . . . . . 4

Metabolism . . . . . 5

Mutagenicity . . . . . 5

Carcinogenicity . . . . . 5

Mineral Oil Toxicity in Laboratory Animals . . . . 5

General Toxic Effects . . . . . 5

Metabolism . . . . . 6

Mutagenicity . . . . . 6

Carcinogenicity . . . . . 7

SECTION 3. ENVIRONMENTAL FATE PROPERTIES OF MINERAL OILS 9

Water Solubility . . . . . 9

Bioaccumulation . . . . . 9

Fate in Soil . . . . . 10

Vapor Pressure . . . . . 10

Biodegradation . . . . . 10

LITERATURE CITED . . . . . 11

## INTRODUCTION

This report describes the toxic and environmental fate properties of mineral oils. The next section describes the chemical and physical properties of mineral oils. The third section discusses the toxic properties of mineral oils in humans and laboratory animals. The final section discusses the environmental fate properties of mineral oils.

## Section 1. CHEMICAL AND PHYSICAL PROPERTIES OF MINERAL OILS

Mineral oils are mixtures of liquid hydrocarbons produced from crude petroleum oils through a series of highly complex processes. In the past, the term "mineral oils" has been used to describe oils derived from coal, shale, petroleum crude oil, and animal and vegetable sources and products ranging from gasoline to asphalt have been referred to as "mineral oils". More recently the term "mineral oils" has been applied to lubricating oils.

The principal uses of mineral oils are as follows: pharmaceutical preparations, cosmetics, food applications, animal feed products, cosmetics, textile-machine lubricants, solvents for pesticides, turbine oils, hydraulic oils, transformer oils, automotive motor oils, and metalworking oils.

The International Agency for Research on Carcinogens (IARC, 1984) stated that "In view of problems of nomenclature and of the wide differences in the production, uses and chemical, physical and toxicological characteristics of petroleum refinery materials, a system for defining petroleum crude oil refinery process streams was adopted in 1978 under the U.S. Toxic Substance Control Act (TSCA) and in 1981 under the Commission of the European Communities' Sixth Amendment to the Dangerous Substances Directive - European Inventory of Existing Commercial Chemical Substances (EINECS). Each stream is defined on the basis of petroleum crude oil type, viscosity and process, and is identified by a Chemical Abstract Services (CAS) Registry Number, which identifies its last refining process."

The important refinery streams (most of which are used as lubricant base oils) that are included on the TSCA inventories of chemical substances in the United States and Europe and the products derived from them have been divided into eight classes based on increasing severity of processing or refinement by IARC:

Class 1. Vacuum distillates: These may have undergone subsequent finishing steps, such as caustic neutralization, dewaxing, clay treatment and/or mild hydrotreatment. They have not been acid treated or solvent extracted.

Class 2. Acid-treated oils: These may have undergone subsequent finishing steps, such as caustic neutralization, dewaxing, clay treating and/or mild hydrotreatment. They have not been solvent extracted.

Class 3. Solvent-refined-oils (raffinates): These may have undergone subsequent finishing steps, such as dewaxing, clay treating and/or mild hydrotreatment.

Class 4. Hydrotreated oils

Class 5. White oils and petrolatums suitable for food and/or medicinal use

Class 6. Aromatic oils
6.1 Solvent extracts
6.2 Catalytically cracked oils

Class 7. Miscellaneous materials
7.1 Formulated products
7.2 Used oils

Class 8. Petroleum-derived materials not otherwise classified (not sufficiently described to permit assignment to other classes)

Mineral oils are colorless, oily liquids, that are practically tasteless, and odorless; insoluble in water and alcohol but soluble in benzene, chloroform, and ether (Sax 1984).

Synonyms for mineral oils include petroleum distillate, petroleum hydrocarbon, paraffin oil, liquid petrolatum, white mineral oil, and technical white oil.

Mineral oils undergo a wide variety of chemical reactions because they contain high molecular-weight paraffinic, cycloparaffinic, and aromatic hydrocarbons. The reactions include oxidation, hydrogenation, halogenation, and sulfonation.

The physical properties of mineral oils are summarized in table 1-1.

Table 1-1--Physical Properties of Mineral Oils (white oils)

| | | |
|---|---|---|
| Physical State | : | oily liquid |
| Color | : | colorless |
| Odor | : | none |
| Viscosity ($mm^2/sec$) at 40° C | : | 14.2-68.7 |
| Flash Point (°C) | : | 195-230 |
| Density (kg/l) at 15 °C | : | 0.843-0.890 |
| Solubility | : | Insoluble in water and alcohol, soluble in benzene, chloroform, and ether |

Sources: Sax 1984; IARC 1984

Medicinal white oils (class 5) are highly refined colorless oils free from unsaturated compounds and other constituents that influence color, odor, taste, and acceptability as a pharmaceutical and food-grade material (World Health Organization 1982). They contain hydrocarbons predominantly with carbon numbers in the range of 15 to 50 (US EPA 1978). Technical-grade white oils are less refined than medicinal oils

## Section 2. TOXICITY OF MINERAL OILS

### Toxicity Summary of Mineral Oils

Based on acute oral $LD_{50}$s of greater than 25 ml/kg in rats and acute dermal $LD_{50}$s of greater than 5 g/kg in rabbits, mineral oils can be classified as very slightly toxic (Maxwell 1982, as cited in Walstad and Dost 1984). Mineral oils are slight skin irritants but are not skin sensitizers. Mineral oils are also not eye irritants. Available data indicate that mineral oils are not mutagenic. There is no evidence for carcinogenicity in experimental animals of solvent-refined oils, white oils and petrolatum. However, there is some evidence for carcinogenicity of less refined oils in animals.

An association between exposure to mineral oil and the development of occupational skin cancer in man has been established. However, it has been demonstrated that the refining process influences the carcinogenic potential of mineral oil. Most lubricating mineral oil in use today is not carcinogenic because of newer refining techniques (such as hydrotreatment or solvent extraction) as assayed by mouse skin painting. In contrast, oils refined by the older acid/earth process are carcinogenic. Therefore, these facts must be borne in mind when considering epidemiology studies of workers exposed to lubricating oils prior to or for some years after World War II.

The majority of both human and laboratory animal studies discussed below were taken from the Monographs of International Agency for Research on Cancer (IARC, 1984).

**Mineral Oil Toxicity in Humans**

General Toxic Effects

The toxic effects of petroleum-derived oils in humans were reviewed by Jampolis et al., 1953, Key et al., 1966, Kipling 1967, and Hodgson 1970 as cited in IARC (1984).

The major sites of the toxicity of petroleum-derived oils are the skin and the lungs. Toxic effects observed on the skin are eczematous dermatitis, contact dermatitis, folliculitis, oil acne, lipid granuloma and melanosis (Hodgson 1970 as cited in IARC). Habitual use of large amounts of mineral oil (paraffin oil or liquid petrolatum of class 5) suitable for food and medicinal use by nasal, oral, or pharyngeal administration for prolonged periods of time result in lipid granuloma (localized lipid pneumonia) of the lung (Jampolis et al., 1953, as cited in IARC 1984).

The occupational exposure limit for mineral-oil mist in the U.S. is 5 $mg/m^3$ on an eight-hour time-weighted average (TWA). The American Conference of Governmental Industrial Hygienists (1982) recommends a short-term exposure limit (STEL) of 10 $mg/m^3$.

The U.S. Environmental Protection Agency (EPA) has established tolerances for total residues of mineral oil (class 5) of 0.2 g/kg in or on shelled corn and grain sorghum from post-harvest applications. Mineral oil-class 5 is exempted from the requirement of a tolerance when used as an ingredient in formulations

of pesticidal products for growing crops or for raw agricultural commodities after harvest (US EPA 1982a).

Mineral oil-class 5 is approved for use by the FDA under 21 CFR, Part 172.878 as a direct multipurpose food additive and Part 573.680 in animal feed, subject to the provisions of these subparts.

Metabolism

In general, the absorption of mineral oil-class 5 from the gastrointestinal tract is limited (Anon 1967; Goodman and Gilman 1975 as cited in IARC 1984).

Mutagenicity

The urine of 16 men exposed occupationally to mineral oil-class 8 was tested for mutagenicity in Salmonella typhimurium strains TA98 and TA100 in the presence of rat-liver metabolic system. These workers exhibited mutagenic activity in their urine.

Carcinogenicity

Human exposure to the mineral oils (lubricant base oils and derived products excluding class 5) varies widely. Among occupations, including mulespinning, metal machine and jute processing, exposure to these materials has been associated with the occurrence of squamous-cell cancers of the skin, and especially of the scrotum.

The epidemiological studies of metal industry workers reported excessive gastrointestinal malignancies in each of the three cohort studies. Also excesses of bladder cancer have been reported in case-control studies in several countries among machinists and engineers who were exposed to cutting oils (containing aromatic amines).

**Mineral Oil Toxicity in Laboratory Animals**

General Toxic Effects

Toxic effects of mineral oils in animals are reviewed by Bingham et al., 1980, Chircova 1982, and World Health Organization 1982 as cited in IARC (1984).

No alteration in respiratory function was observed in guinea pigs exposed to mineral oil-class 5 at concentrations of 10 or 40 $mg/m^3$ for one hour (Costa and Amdur 1979, as cited in IARC 1984). Aspiration of 0.2 ml mineral oil-class 5 by rats caused no mortality after 24 hours. This oil did not produce the severe acute pulmonary edema or hemorrhage characteristic of kerosene (Gerarde 1963 as cited in IARC 1984). A survival rate of 77 percent was observed in 13 mice exposed to an aerosol of mineral oil (US Pharmacopeia grade liquid petrolatum-class 5) at a concentration of 4,500 $mg/m^3$ intermittantly for a total of 80-84 hours over a 4-week period (Shoshkes et al., 1950 as cited in IARC 1984). This oil produced localized foreign-body reactions in the lung as well as patches of lipid pneumonia.

No toxic effects were observed in rats receiving mineral oil-class 5 at an oral (gavage) dose of 2 ml/kg three times weekly for three months (Kimborough et al. 1980, as cited in IARC 1984). Beck et al. 1983 (as cited in Kane et al., 1984) showed that solvent-refined naphthenic oil-class 3 has a low order of acute toxicity. This oil had an oral $LD_{50}$ value of greater than 25 ml/kg and dermal $LD_{50}$ value of greater than 5 g/kg, was slightly irritating to skin based on the primary dermal irritation test but was not a skin sensitizer based on the guinea pig skin sensitization test, and not irritating to eyes based on the primary eye irritation test.

Metabolism

Ebert et al. 1966 (as cited in IARC 1984) orally administered radio-labelled mineral oil-class 5 to rats at 0.66 ml/kg. Five hours after oral administration, 1.5 percent of the administered dose was found in the carcasses as non-mineral oil substances. However, liver, fat, kidney, brain, and spleen contained mineral oil (the amount of oil after administration was not specified). Within 2 days after administration, the amount of mineral oil found in the animals was 0.3 percent of administered dose.

Mutagenicity

No mutagenic activity was found when mineral oil-class 5 was tested for mutagenicity in S. typhimurium strain TA98 in the presence of rat liver S9 metabolic system (Hermann et al. 1980 a, b).

Carcinogenicity

In a 500-day feeding study, rats received 2 percent liquid paraffin-class 5 in the diet. The total dose received was 136 ml per animal. No significant tumor induction was observed (Schmähl and Reiter 1953 as cited in IARC 1984).

Groups of 50 male and 50 female rats were fed three samples of petrolatum (class 5) (snow-white USP XVI grade, white USP XVI grade, and yellow National Formulary XI grade) at a concentration of 5 percent in their diet for 2 years. No significant tumor induction was observed in these tests at the dose studied (Oser et al. 1965, as cited in IARC 1984).

Mouse skin tumorigenicity studies of mineral oil of different classes were reported by Kane et al., 1984. Male C3H or C3H/HeJ mice received skin applications of 25-100 mg or 0.2 ml of test materials 2 or 3 times each week for 80 weeks until a tumor was grossly diagnosed or for lifetime of the animals until an advanced tumor was grossly diagnosed. This study showed that unprocessed refinery distillates (class 1) caused tumors and solvent refining removed the tumorigenic components. The results obtained by Halder et al. 1984 (as cited in IARC 1984) confirmed the work of Kane et al. (1984).

Groups of 27 or 50 mice were given skin applications of 12 mineral oils once or twice weekly or once every two weeks for 78 weeks (Doak et al. 1983). The amount of test materials applied was 0.25 ml for the first 22 weeks followed by 0.2 ml. Malignant skin tumors were found in 4/27 animals painted acid-treated naphthenic distillate (class 2). Among the 11 oils processed by other refining routes, 2 oils were less carcinogenic and 9 oils including white oil (class 5) which had been solvent-refined were non-carcinogenic to skin.

A group of 130 mice were exposed daily to an aerosol (mean particle diameter, 1.3 μm) generated from a light white naphthenic oil (class 5) at a concentration of 100 mg/m$^3$ for 7-13 months. Animals were sacrificed at monthly intervals. No significant tumor induction was observed (Wagner et al. 1964, as cited in IARC 1984). These authors also tested this material in rabbits, rats, hamsters, and dogs by exposing them to concentrations of 5 and 100 mg/m$^3$ for periods of 6-26 months. No tumors were reported in the treated animals.

A summary of mouse skin tumorigenicity presented in IARC 1984 is shown in table 2-1. There is sufficient evidence for the carcinogenicity in

experimental animals of vacuum distillates (class 1), acid-treated oils (class 2), mildly solvent-refined oils (class 3), mildly hydrotreated oils (class 4), and aromatic oils (class 6). There is no evidence for carcinogenicity in experimental animals of severely solvent-refined oils (class 3) and white oils and petrolatums (class 5). However, the data are inadequate to evaluate severely hydrotreated oils (class 4), formulated products (class 7.1), and used oils (class 7.2).

Table 2-1. Summary of Tumorigenicity in Experimental Animals

| IARC Classification | Tumorigenicity |
|---|---|
| Class 1. Vacuum distillates | Sufficient evidence |
| Class 2. Acid-treated oils | Sufficient evidence |
| Class 3. Solvent-refined oils | |
| Mildly treated | Sufficient evidence |
| Severely treated | No evidence |
| Class 4. Hydrotreated Oils | |
| Mildly treated | Sufficient evidence |
| Severely treated | Inadequate evidence |
| Class 5. White oils and petrolatums | No evidence |
| Class 6. Aromatic oils | Sufficient evidence |
| Class 7. Miscellaneous materials | |
| 7.1 Formulated products | Inadequate evidence |
| 7.2 Used oils | Inadequate evidence |

## Section 3. ENVIRONMENTAL FATE PROPERTIES OF MINERAL OILS

Mineral oils are mixtures of a variety of long-chain hydrocarbons (chemicals containing primarily carbon and hydrogen). While the environmental fate properties of a large number of individual chemicals have been studied, the fate properties of the longer-chain hydrocarbons have not been well studied. Environmental fate information does not appear to be available on individual large hydrocarbons. Defining the fate properties of a poorly defined mixture of these larger hydrocarbons would be difficult even if the requisite information existed for the individual hydrocarbon constituents.

Literature information on the environmental fate properties of octane and of diesel oil and kerosene is available to a limited degree. Octane is an 8-carbon simple chain hydrocarbon. Diesel oil and kerosene, like mineral oils, are mixtures of hydrocarbon compounds. Octane and the hydrocarbons found in diesel oils and kerosene are shorter in length and lighter than those in mineral oils. Based on the differences between the composition octane and of of diesel oil and kerosene and the composition of mineral oils, it is possible to draw inferences about the environmental fate properties of mineral oils relative to octane, diesel oils, and kerosene.

### Water Solubility

The water solubility of octane is 0.66 mg/L at 25 C. Octane should be expected to be more soluble in water than mineral oils due to its smaller molecular size and weight.

### Bioaccumulation

A measure of the affinity of a chemical for water versus an organic solvent is the octanol-water partition coefficient ($K_{ow}$). Measurement of this coefficient is performed by adding the test chemical to a system which contains water and octanol, which are immiscible. Compounds which readily dissolve in the water phase have a very low $K_{ow}$ value. Conversely, compounds which more readily dissolve in the octanol phase have a high $K_{ow}$ value. A direct relationship exists between the number of carbon atoms and the $K_{ow}$ of a compound. The more carbons, the less soluble in water and the higher the $K_{ow}$. The $K_{ow}$ of the 8-carbon octane is approximately 10,000 (Mabey et al., 1982). In mineral oils, the hydrocarbon components generally fall in the range of 15 to 50 carbon atoms. Therefore, the $K_{ow}$ of mineral oil is expected to be greater than 10,000.

The $K_{ow}$ value is often used as a measure of the bioaccumulative tendency of a chemical. Organisms contain a large proportion of lipids (fats and oils), and chemicals which have high $K_{ow}$ values are more likely to accumulate in these lipid materials. The ability of a chemical to bioaccumulate is sometimes measured experimentally, but is more often calculated by a formula relating $K_{ow}$ to the bioconcentration factor (BCF). A common formula for performing this calculation is given by Veith et al. (1979 in Lyman et al., 1982):

$$\log BCF = 0.76 \log K_{ow} - 0.23$$

Using the Veith equation, the calculated BCF of octane is 646. Mineral oils, because of their expected higher $K_{ow}$, would be expected to have higher BCF values, that is, they would tend to more readily concentrate in animal lipid tissues.

Fate in Soil

Octane adsorbs readily to soils, with a distribution coefficient ($K_d$) of 110 L/g (calculated by Lyman et al., 1982). Because of the larger carbon structures and lower water solubilities, the components of mineral oil will be more likely to adsorb to soils than octane.

Vapor Pressure

Diesel oil exhibits a vapor pressure of 2.07 mm Hg at 40 C. Owing to the lighter, more volatile components of diesel oil, mineral oil should have a lower vapor pressure and therefore be less volatile.

Biodegradation

The biodegradation constant of octane is approximately 0.11 $day_{-1}$ (Ladd, 1956). Because of the lower relative water solubility of mineral oils (chemicals must be dissolved in water to be consumed by microorganisms), the greater relative soil adsorption of mineral oils (chemicals adsorbed to soil are unavailable for biodegradation and are less likely to partition to water), and the larger molecular size and weight, mineral oil components would be expected to have a biodegradation rate much lower than octane.

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# APPENDIX A

## Supplement No. 2

In response to public comments received during the 90-day response period data for tebuthiuron and limonene have been updated. Pages presented here replace pages in the Risk Assessment published with the Draft EIS. These are the only pages affected by the update. No changes were required in chapter IV of the Final EIS as a result of this update.

Table 3-2 (continued)

Laboratory-determined toxicity levels used in the risk analysis

| Chemical | Lowest Acute Oral $LD_{50}$ in Rats | Lowest Systemic NOEL | Lowest Reproductive, Maternal or Fetotoxic, and/or Teratogenic NOEL |
|---|---|---|---|
| Tebuthiuron[b] | 388 - 478 mg/kg[c] | 12.5 mg/kg/day, 3-month dog feeding study (EPA, 1984e) | Reproductive NOEL = 5.0 mg/kg/day, 2-generation rat study (EPA, 1987f) |
| Triclopyr[a] | 630 mg/kg (EPA, 1986f) | 2.5 mg/kg/day (HDT), 6-month dog feeding study (40 CFR Part 180, 50 (84):184-85, May 1, 1985) | Fetotoxic NOEL less than 10 mg/kg/day, rabbit teratology study (EPA, 1986f) |

[a]A 2-year rat, mouse, or dog feeding study established a higher systemic NOEL but the lower subchronic NOEL was used.
[b]No valid chronic studies available.
[c]Elanco. 1989. Information in letter written in response to Draft EIS.
Conversion Factors:
mouse 1 ppm = 0.150 mg/kg/day
rat (lifetime) 1 ppm = 0.05 mg/kg/day
rabbit 1 ppm = 0.030 mg/kg/day
dog 1 ppm = 0.025 mg/kg/day
Source: USDA, 1984.

In a 3-generation rat reproduction study, a NOEL of 50 mg/kg/day was established based on reduced fertility at the highest dose tested of 150 mg/kg/day (EPA, 1988). In a rat teratology study, maternal toxicity was observed at 750 mg/kg and fetal toxicity (delayed bone ossification) was observed at 500 mg/kg (EPA, 1984f). No teratogenic effects were observed, and the NOEL was established as greater than 1,000 mg/kg, the highest dose tested. No dose-related embryotoxic or teratogenic responses were observed in rabbits given doses of picloram of up to 400 mg/kg/day (John-Greene et al., 1985).

Sulfometuron Methyl

Sulfometuron methyl is very slightly toxic, based on an acute oral $LD_{50}$ of greater than 5,000 mg/kg in rats (EPA, 1984c). In acute dermal studies, an $LD_{50}$ of greater than 2,000 mg/kg was reported (EPA, 1984d). Reversible eye and skin irritation was observed in primary eye and primary dermal irritation studies using rabbits (EPA, 1984d). A 90-day rat feeding study established a systemic NOEL of 50 mg/kg/day, based on hematological effects observed at 250 mg/kg/day (EPA, 1984d). A combined 2-year rat feeding and two-generation reproduction study reported by DuPont (1986) established a systemic NOEL of 2.5 mg/kg/day. In this study, hemolytic effects, liver toxicity, and decreased mean absolute body and brain weights, but not the brain-to-body weight ratio, were observed at 250 mg/kg/day. Hemolytic effects and liver toxicity were also observed at 25 mg/kg/day. In a 1-year dog feeding study, a systemic NOEL of 5 mg/kg/day was reported (EPA, 1984d). Effects observed in dogs included decreased number of red blood cells and increased liver weight at 25 mg/kg/day.

In the two-generation rat reproduction study, a NOEL of 25 mg/kg/day was established, based on reduced maternal food consumption and body weight gains and reduced numbers of offspring (DuPont, 1986). A one-generation rat reproduction study resulted in the establishment of a reproductive NOEL of greater than 250 mg/kg/day (HDT) (EPA, 1984d). A rat teratology feeding study reported reduced body weight gain at 250 mg/kg/day and maternal and fetal toxic NOEL's of 50 mg/kg/day (EPA, 1984d). No teratogenic effects were observed at 250 mg/kg/day, the highest dose tested. A rabbit teratology study was negative for teratogenic, maternal, and fetal toxic effects at 300 mg/kg, the HDT (EPA, 1984d).

Tebuthiuron

No EPA-validated studies exist for assessing acute dermal or acute oral toxicity of tebuthiuron (EPA, 1987c). Of the many studies reported by EPA, the lowest acute oral $LD_{50}$ was 644 mg/kg in rats. Based on this study, tebuthiuron is classified as slightly toxic (EPA, 1986e). Elanco (1989) reports a lower oral $LD_{50}$ in rats, in the range of 388 to 478 mg/kg. A systemic NOEL of 83.1 mg/kg/day (EPA, 1984e) was established from a 119-day mouse feeding study. In a recent registration document from EPA (1987c), a systemic NOEL of 25.0 mg/kg/day was found in a 1-year dog feeding study. A more conservative systemic NOEL of 12.5 mg/kg/day was established for a 3-month dog feeding study, based on increased thyroid-to-body weight values

and increased blood enzyme levels (EPA, 1986e). Toxic effects in other subchronic studies included growth suppression and pancreatic lesions at 125 mg/kg/day in rats, and body weight depression at 37.5 mg/kg/day in cattle (EPA, 1986e). Tebuthiuron caused no eye or skin irritation in rabbits during primary eye and primary dermal studies (EPA, 1986e). Tebuthiuron, however, was skin irritating in an acute dermal study using rabbits (EPA, 1986e).

A three-generation reproduction study with rats reported a reproductive NOEL of less than or equal to 20 mg/kg/day (LDT), based on the decreased body weight of weanling pups (EPA, 1986e). In a two-generation reproduction study with rats, EPA reported a NOEL of 5.0 mg/kg/day, based on a low rate of maternal body weight gain (EPA,1987f).

The only study of teratogenicity supplied to EPA was found invalid. Two mammalian teratogenic studies are required to complete reregistration standards for tebuthiuron (EPA, 1987c). The study performed did show that there were no observable teratogenic effects at the highest dose tested (90 mg/kg) (EPA, 1986e).

Triclopyr

With an acute oral $LD_{50}$ ranging from 630 to 729 mg/kg in rats (EPA, 1986f), triclopyr is classified as slightly toxic (table 3-1). A systemic NOEL of 30 mg/kg/day was established, based on a 90-day rat feeding study that resulted in decreased body weight, food consumption, and absolute liver weights (EPA, 1986f). A 2-year feeding/oncogenic study observed no effects on hematology, clinical chemistry, and urinalysis at 30 mg/kg/day (HDT) (EPA, 1986f). In a recent 2-year chronic toxicity-oncogenicity study reported by Dow (1987a), no toxicological effects were observed in rats at 3 mg/kg/day. Male rats fed 12 and 36 mg/kg/day had increased absolute and relative kidney weights. Acute and primary dermal tests revealed that triclopyr was slightly irritating to the skin of rabbits (EPA, 1986f). A primary eye irritation test demonstrated that triclopyr was irritating to rabbit eyes (EPA, 1986f).

A 228-day dog feeding study resulted in a systemic NOEL of less than 5 mg/kg/day, based on decreased weight gain and food consumption (Dow, 1983, as cited in USDA, 1984; EPA, 1986f). A 6-month feeding study with dogs resulted in the establishment of a systemic NOEL of 2.5 mg/kg (HDT) (40 CFR Part 180 50(84):184-85, May 1, 1985). The effects found in the dog studies are not representative of effects expected in humans because dogs have a limited capacity for organic anion transport in the kidney (Dow, 1985). Dogs excrete triclopyr at a slower rate than other laboratory animals or humans. The half-life of triclopyr for urinary excretion in dogs is 96 hours, compared to 1.5 hours in rats and 3.1 hours in monkeys. Dow concluded that toxicity may be increased in dogs because of the greater relative retention time of the compound in the animal's body. Therefore, the use of the NOEL from the dog study (the lowest NOEL found in the literature) in this risk assessment is very conservative and tends to cause an overestimate of expected effects in humans with normal renal function.

Table 4-6 (continued)

Typical and maximum anticipated application rates in pounds per acre a.i. in Region 8

| Application Method | Light Fuel Oil | Limonene | Picloram | Sulfometuron Methyl | Tebuthiuron[a] | Triclopyr Amine | Triclopyr Ester |
|---|---|---|---|---|---|---|---|
| Aerial[a] | | | | | | | |
| Foliar | 0.5 [1.5] | 0.9 [3.6] | 0.5 [1.5] | 0.13 [0.4] | 1.0 [6.0] | 3.0 [6.0] | 4.0 [8.0] |
| Granular/pellets | | | | | 1.0 [6.0] | | |
| Mechanical | | | | | | | |
| Foliar | 2.0 [3.5] | 0.9 [3.6] | 0.7 [1.4] | 0.17 [0.4] | 1.0 [6.0] | 4.0 [8.0] | 4.0 [8.0] |
| Granular/pellets | | | | | 1.0 [6.0] | | |
| Manual Ground | | | | | | | |
| Application method Granular/pellets | | | | | | | |
| Foliar-backpack/hand-sprayer (directed, herbaceous, etc.) | 1.5 [2.5] | 0.9 [1.8] | 0.4 [0.5] | 0.06 [0.25] | 4.0 [7.0] | 1.4 [2.0] | 1.0 [3.0] |
| Basal bark/stem | 1.0 [2.0] | 0.9 [2.7] | | | | | 1.9 [3.0] |
| Basal soil/soil spot | | | | | 4.0 [7.0] | | |
| Cut surface (frill, injection cut stump, hack and squirt, etc.) | | | 0.3 [0.6] | | | 1.0 [2.5] | |

[ ]--Maximum anticipated

[a]Values are estimated; chemical or application method not currently used.

Table 4-35

Limonene exposures

| Category | Exposure (mg/kg/day) Typical | Maximum |
|---|---|---|
| Public | | |
| Dermal | | |
| Drift | 0.00007 | 0.00042 |
| Onsite | 0.00054 | 0.00215 |
| Dietary | | |
| Water | 0.00002 | 0.00013 |
| Fish | 0.00000 | 0.00003 |
| Meat | 0.00002 | 0.00566 |
| Vegetable | 0.00017 | 0.00096 |
| Berry Picking | 0.00014 | 0.04193 |
| Workers | | |
| Aerial | | |
| Pilot | 0.00285 | 0.07248 |
| Mixer/Loader | 0.00709 | 0.10368 |
| Observer | 0.00009 | 0.00235 |
| Mechanical Ground | | |
| Applicator | 0.00401 | 0.64286 |
| Mixer/Loader | 0.00955 | 0.65481 |
| Appl/Mix/Load | 0.00941 | 0.90361 |
| Manual Ground | | |
| Backpack | 0.04629 | 0.44514 |
| Basal Stem | 0.03107 | 0.09770 |
| Accidents | | |
| Spill Onto Worker | | 432.0000 |
| Accidental Spray | | 0.1502 |
| Spills Into Water | | |
| Ground--18.9 l Into Pond | | 0.0663 |
| Air--379 l Into Reservoir | | 0.0021 |

Table 5-18

Limonene margins of safety

| Exposure Type | Systemic | | Reproductive | |
|---|---|---|---|---|
| | Typical | Maximum | Typical | Maximum |
| Public | | | | |
| Dermal | | | | |
| Drift | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Onsite | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Dietary | | | | |
| Water | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Fish | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Meat | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Vegetable | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Berry picking | 10000.0 | 5400.0 | 10000.0 | 5413.4 |
| Workers | | | | |
| Aerial | | | | |
| Pilot | 10000.0 | 3100.0 | 10000.0 | 3131.9 |
| Mixer/loader | 10000.0 | 2200.0 | 10000.0 | 2189.4 |
| Observer | 10000.0 | 10000.0 | 10000.0 | 10000.0 |
| Mechanical ground | | | | |
| Applicator | 10000.0 | 350.0 | 10000.0 | 353.1 |
| Mixer/loader | 10000.0 | 350.0 | 10000.0 | 346.7 |
| Appl-mix/load | 10000.0 | 250.0 | 10000.0 | 251.2 |
| Manual ground | | | | |
| Backpack | 4900.0 | 510.0 | 4903.4 | 510.0 |
| Basal stem | 7300.0 | 2300.0 | 7306.4 | 2323.4 |
| Accidents | | | | |
| Spill onto worker | | -1.9 | | -1.9 |
| Accidental spray | | 1500.0 | | 1511.8 |
| Spills into water | | | | |
| Ground--18.9 l into pond | | 3400.0 | | 3424.6 |
| Air--379 l into reservoir | | 10000.0 | | 10000.0 |

Note: Margins of safety greater than 10,000 are listed as 10000. Margins of safety were based on a systemic NOEL of 227 and a reproductive NOEL of 227.

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# Effects of Prescribed Fire on Soil and Water in Southern National Forests

APPENDIX B

See Appalachian Mountains Draft EIS

# Effects of Herbicides on Soil Productivity and Water Quality

See Appalachian Mountains Draft EIS

APPENDIX C

# A Biological Evaluation of the Effects of the Preferred Alternative on Threatened, Endangered, Proposed, and Sensitive Species

APPENDIX D

# APPENDIX D

A BIOLOGICAL EVALUATION OF THE EFFECTS
OF THE PREFERRED ALTERNATIVE ON
THREATENED, ENDANGERED, PROPOSED, AND SENSITIVE SPECIES

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## Summary

This biological evaluation addresses the effects of vegetation management activities described in the Environmental Impact Statement for Vegetation Management in the Appalachian Mountains for the Southern Region of the U. S. Forest Service on threatened, endangered, proposed, and sensitive species. Effects of the program are determined to be beneficial or not detrimental. For threatened, endangered, and proposed species, concurrence from the USDI Fish and Wildlife Service is recommended. For sensitive species, informal coordination between affected national forests and appropriate state heritage agencies is recommended.

## Introduction

Objectives:

The objectives of this biological evaluation are to:

1. Determine the effects of the program of vegetation management activities identified in the preferred alternative on threatened, endangered, and proposed plant and animal species occurring on national forests in the Appalachian Mountains.

2. Determine the effects of the program of vegetation management activities identified in the preferred alternative on sensitive plant and animal species occurring on national forests in the Appalachian Mountains.

3. Describe measures to be taken to mitigate potential adverse effects of activities described in the preferred alternative on threatened, endangered, or proposed species.

4. Describe measures to be taken to mitigate potential adverse effects of activities described in the preferred alternative on sensitive species.

This evaluation does not attempt to evaluate the effects of individual vegetation management projects on any species.

This biological evaluation was prepared in accordance with Forest Service Manual 2671.44 and 2672.43 and regulations set forth in section 7(a) of the Endangered Species Act (ESA).

Thirty-three animal species classified by the USDI Fish and Wildlife Service (FWS) as threatened or endangered (or proposed for listing as threatened or endangered) live in Appalachian Mountain national forests. The list includes six species of mammals, three species of birds, one species of reptile, eight fish species, and 15 species of mollusk (table F-1 of the EIS). Fourteen plant species with Federally threatened or endangered status (table E-2 of the EIS) occur. Habitats of these species are managed under authority of the Endangered Species Act with the goal of population recovery.

In addition, certain species for which population viability is a concern are designated by the Regional Forester as "Sensitive." Normally, this designation is established with the concurrence and guidance of the appropriate State Heritage Agency. Species listed in tables F-3 and F-4 include species so designated at the time this appendix was prepared. Habitats of sensitive species are managed to ensure population levels which will keep these plants and animals from becoming threatened or endangered.

Evaluation Methods

This evaluation was conducted from June 1 - November 1, 1988 and is based upon:

1. Review of FSH 2609.23R-R8 AMEND. (The Wildlife Habitat Management Handbook) chapters 418 and 420.

2. Review of recovery plans for the southern bald eagle, red-cockaded woodpecker, eastern cougar, American peregrine falcon, Virginia roundleaf birch, mountain golden heather, small whorled pogonia, gray bat, Indiana bat, Virginia big-eared bat, conasauga logperch, slender chub, spotfin chub, smoky madtom, yellowfin madtom, noonday snail, birdwing pearly mussel, shiny pigtoe pearly mussel, Appalachian monkey-face pearly mussel, fine-rayed pigtoe pearly mussel, dromedary pearly mussel, yellow-blossom pearly mussel, green-blossom pearly mussel, and tan riffle shell pearly mussel.

3. Review of the scientific literature related to effects of vegetation management on listed species, including the following references:

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Webster, W. D.; Parnell, J. F.; Biggs, W. C., Jr. 1985. Mammals of the Carolinas, Virginia, and Maryland. Chapel Hill, NC: Univ. N. C. Press. 255 p.

Wolford, B. E. 1980. Inventory of proposed threatened and endangered plant species - Cherokee National Forest, Tennessee. Knoxville, TN: Univ. Tenn. 1-28-7.

4. Review of relevant sections of the Federal Register.

5. Information presented in the EIS and appendices, including appendix A, the Risk Assessment for the Use of Herbicides in USDA Forest Service Southern Region.

6. Discussions with U. S. Forest Service biologists, botanists, and other specialists:

Ron Escano
Jimmy Huntley
Monte Seehorn
Jim Herrig

Levester Pendergrass
Joe Dabney
Oscar Stewart
David Saugey
Larry Hedrick
Don Bethancourt
Ben Sanders
Mickey Beland
Lauren Hillman
Gary Peters
Joan Walker
Tom Bryce

7. Discussions with other experts:

Paul Robertson, Bat Conservation Institute, Austin, TX
Ronald Eisler, USDI, Fish and Wildlife Service
Larry Landers, Tall Timbers Research Station
William McComb, Oregon State University
Phil Sczerzenie, LaBat-Anderson, Inc.
George Hurst, Mississippi State University
James A. Organ, University of New York
John Pagels, Virginia Commonwealth University
John R. Baker, Virginia Dept. of Game & Inland Fisheries
Jenny Dalton, Radford University
Alan Weakley, North Carolina Natural Heritage
Harry LeGrand, Jr., North Carolina Natural Heritage
Doug Rayner, South Carolina Heritage Trust
Paul Somers, Tennessee Department of Conservation
Douglas W. Ogle, Virginia Highlands Community College
Tom Weiboldt, Virginia Polytechnic Institute & State University
Virginia Natural Heritage Program, Department of Conservation and Historic Resources
Michael P. Schafale, North Carolina Natural Heritage
Tom Patrick, Georgia Natural Heritage Inventory
Douglas N. Rader, Environmental Defense Fund (Letter)
Timothy Kuryla, Kentucky Natural Resources And Environmental Protection Cabinet (Letter)
Allen Boynton, North Carolina Wildlife Resources Commission (Letter)
R. T. Bay, USDI, Fish and Wildlife Service (Letter)
Richard Jackson, Lees - McRae College (Letter)
James H. Lee, USDI, Office of Environmental Project Review (Letter)

8. Informal consultation with FWS Division of Endangered Species, Wildlife Enhancement on January 20, 1987 (Robert Cooke); July 2, 1988 (Debbie Kraus); September 19-20, 1988 (Debbie Minon); and September 21, 1988 (Debbie Minon, Debbie Kraus, John Fridell).

Much of this information was compiled and analyzed by Cecil Thomas, Wildlife Biologist, USDA Forest Service.

Indications of adverse or beneficial effect shown in tables D-1, D-3, D-5, and D-6 and based on the best professional opinion of the individuals and sources cited in items 1-8 above. They are not necessarily the result of detailed scientific study and should not be construed as a substitute for site-specific analysis.

Affected Area and Proposed Actions

This evaluation examines the program of vegetation management described in the preferred alternative of the EIS. These activities are described in detail in chapter II of the EIS and fall into the broad categories of herbicides, prescribed fire, mechanical, manual, and biological (grazing) methods of managing vegetation. Treatments are employed to accomplish a variety of resource management goals including site preparation for stand establishment, timber and wildlife stand improvement, endangered species habitat management, mountain balds management, and rights-of-way (ROW) maintenance. Effects of these treatments on plants and animals are discussed in detail in chapter IV of the EIS.

Proposed activities occur on national forests in eight States located in the Appalachian Mountains portion of the USDA Forest Service's Southern Region. This area is described in detail in chapter III of the EIS.

Potential Adverse Effects--General Mitigation Measures

As described in mitigation measures detailed in chapter II of the EIS, the following general requirements and measures apply to all vegetation management methods. Each forest may be more restrictive, but not less.

1. All projects will have site-specific analysis, in accordance with the National Environmental Policy Act (NEPA). This environmental analysis will consider site-specific techniques, intensity of application methods, and potential environmental effects of any method considered. A reasonable range of alternative methods, including the use of methods which do not involve herbicides, will be examined and evaluated.

Potential adverse effects on threatened, endangered, and sensitive species will be evaluated.

Requirements and measures for activities affecting threatened, endangered, or proposed species are detailed in species recovery plans and in FSH 2609.23R. Recovery plans have been prepared for the species listed in item 2 of "Evaluation Methods." Chapters in FSH 2609.23R have been prepared for red-cockaded woodpecker and southern bald eagle.

Requirements and measures for activities affecting sensitive species are detailed in Forest Land and Resource Management Plans and amendments.

2. A biological evaluation of how a project may affect any species Federally listed as threatened, endangered, or proposed for listing, or identified by the Forest Service as sensitive, will be conducted as part of the site-specific environmental analysis. Figure D-1 outlines this process.

The site-specific biological evaluation considers all available inventories of threatened, endangered, proposed, and sensitive species populations for the proposed treatment area. When adequate population inventory information is unavailable, it will be collected when the affected site has high potential for occupancy by a threatened, endangered, proposed, or sensitive species. Table D-1 identifies the potential of adverse effects from vegetation management by species. When potential adverse effects are indicated, mitigation measures specified in chapter II of the EIS will be employed to prevent adverse effects.

If it is determined that the project may affect (including beneficial effects) federally-listed endangered, threatened, or proposed species, consultation is initiated with the U. S. Fish and Wildlife Service. If, during informal consultation, it is determined that the project is not likely to adversely affect listed species and the U. S. Fish and Wildlife Service concurs in writing with that determination, consultation is terminated. However, if it is determined that the project is likely to adversely affect listed species, formal consultation is initiated. Figure D-1 outlines this process.

When the evaluation indicates that a project may have any adverse effect on a species or the habitat of a species listed as sensitive, appropriate State wildlife agencies, natural heritage commissions, and other cooperators or species authorities will be contacted to identify coordination measures. These measures will be directed towards ensuring species viability and preventing negative population trends that would result in Federal listing.

Potential Adverse Effects--Threatened, Endangered, and Proposed Animals

Table D-1 displays general information regarding potential effects of vegetation management methods on endangered, threatened, and proposed animals. The likelihood of adverse effect or significant risk of toxic effects is based on use of vegetation management without mitigation measures.

In most cases, properly applied prescribed fire is beneficial or has no effect on the listed species. However, unless proper techniques are employed, bald eagle nest trees and red-cockaded woodpecker cavity trees may be destroyed. Measures detailed in chapter II of the EIS concerning prescribed burn planning and execution and protection of threatened and endangered species habitat, mitigate this effect. Although effects of burning on the Indiana, Virginia big-eared or gray bats are unknown, it is unlikely that prescribed burning would adversely affect these species since any effect of burning on aerial insect populations (the bats' main food source) in foraging areas would be minimal. Aquatic species are not affected.

Herbicides may be used to improve habitat for the red-cockaded woodpecker but may have an adverse effect if applied improperly, resulting in mortality of cavity trees. There is also a potential for toxic effects to most threatened and endangered animals when certain herbicides are applied at extreme rates. Table D-2 displays the risk to terrestrial species from broadcast application at normal and extreme rates and to aquatic species from two accidental spill scenarios.

Several herbicides present a risk of toxic effects to most bird species when broadcast applied during nesting season. At normal rates, a potential for significant risk (exposure greater than 1/10 LD50) to gray, Virginia big-eared, and Indiana bats exists for 2,4-D, 2,4DP, and triclopyr. Measures in chapter II of the EIS regarding selection and application of herbicides, and prohibition of application at extreme rates mitigates risk to animal species except for these species. Measures in chapter II restricting the application of 2,4-D, 2,4-DP, and triclopyr mitigates risk to these species. Table D-2 also shows that all aquatic species would be adversely affected (significant risk of exposure greater than 1/20 LC50) if an accidental spill released sufficient amounts of certain herbicides into a water body they inhabit. Measures in chapter II of the EIS concerning handling, transportation, application, and spill clean-up mitigate this risk by making the likelihood of such exposure extremely low.

There is a significant risk to the embryos of nesting threatened and endangered birds when kerosene, diesel oil, or any herbicide containing kerosene or diesel oil is broadcast applied during nesting season. A mitigation measure in chapter II prohibits such application.

Manual treatments are beneficial when used to improve habitat for the red-cockaded woodpecker. Aquatic species are protected from adverse effects by mitigation measures and forest plan standards and guides which protect riparian habitat and limit treatment near water courses. Manual treatments are unlikely to alter aerial insect populations to the extent that gray, Virginia big-eared, or Indiana bats would be affected adversely. Handbook chapter restrictions protect bald eagle nest sites from disturbance or destruction by manual methods by establishing protection zones around nests. Similar restrictions detailed in recovery plan Protect nest sites of peregrine falcons. Restrictions in a proposed recovery plan protect Virginia northern flying squirrels from manual treatments which would adversely affect flying squirrel habitat.

Soil-disturbing mechanical treatments such as light or heavy disking and bedding may be used to improve the habitat of red-cockaded woodpecker. Aquatic species may be harmed if intensive soil-disturbing treatments result in increased siltation of their habitats. Measures in chapter II of the EIS regarding slope restrictions, distance to water bodies, and soil characteristics, reduce siltation and mitigate this risk. Statements made above regarding manual treatments apply to non soil-disturbing mechanical treatments as well.

Effects from biological methods generally do not occur since grazing is not conducted in the habitat of most of the listed species. Grazing may be used to improve habitat conditions for red-cockaded woodpecker. Heavy grazing near riparian areas could adversely affect aquatic species. Measures in chapter II of the EIS designed to protect riparian areas from grazing, mitigate these effects.

Potential Adverse Effects--Threatened, Endangered, and Proposed Plants

Table D-3 displays the general potential for adverse impacts of vegetation management treatment on threatened, endangered, and proposed plant species.

Prescribed fire probably improves the habitat of Hudsonia montana, Liatris helleri, and Sarracenia oreophila; adversely affects Arabis serotina, Arenaria cumberlandensis, Betula uber, Helonias bullata, Iliamna corei, Scutellaria montana, Solidago albopilosa, and Trillium persistens; and does not occur where Pityopsis ruthii is found. Manual methods may be used to improve habitat for B. uber, H. montana, I. corei, Isotria medeoloides, L. helleri, P. ruthii, S. oreophila, and S. spithamea; but should be excluded from areas where A. serotina, A. cumberlandensis, H. bullata, S. montana, S. spithamea, or T. persistens occur. Mechanical methods can adverse affect A. serotina, B. uber, H. bullata, I. corei, I. medeoloides, L. helleri, S. oreophila, S. montana, and T. persistens and do not occur where the other listed plants are found. Grazing is probably detrimental to all the plant species listed in table D-3.

Measures in chapter II of the EIS concerning inventory and site-specific environmental assessment requirements mitigate these effects.

All of the herbicides considered for use have the potential to adversely affect any of the listed plants. Measures in chapter II of the EIS concerning application and handling of herbicides and prohibiting application by air within 300 feet or by ground within 60 feet of any endangered, threatened, or proposed plant mitigate these effects.

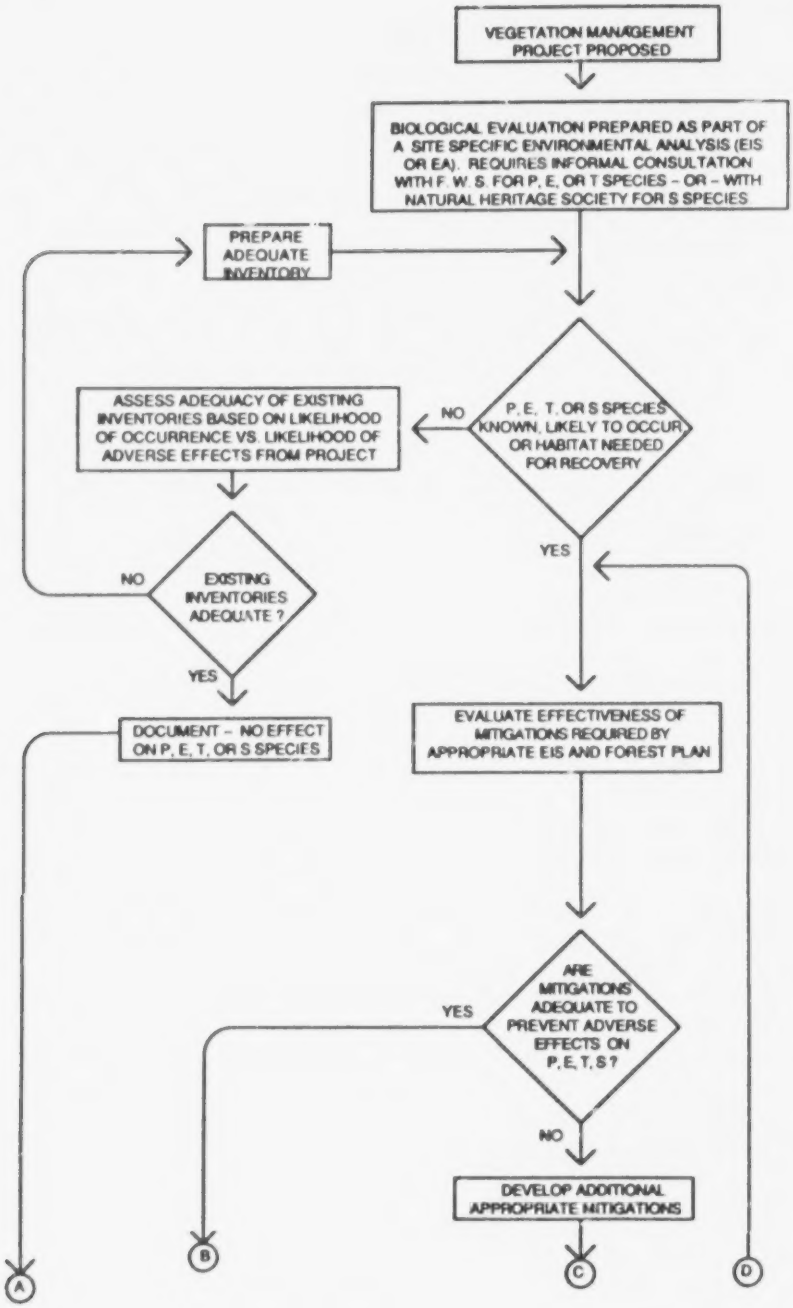
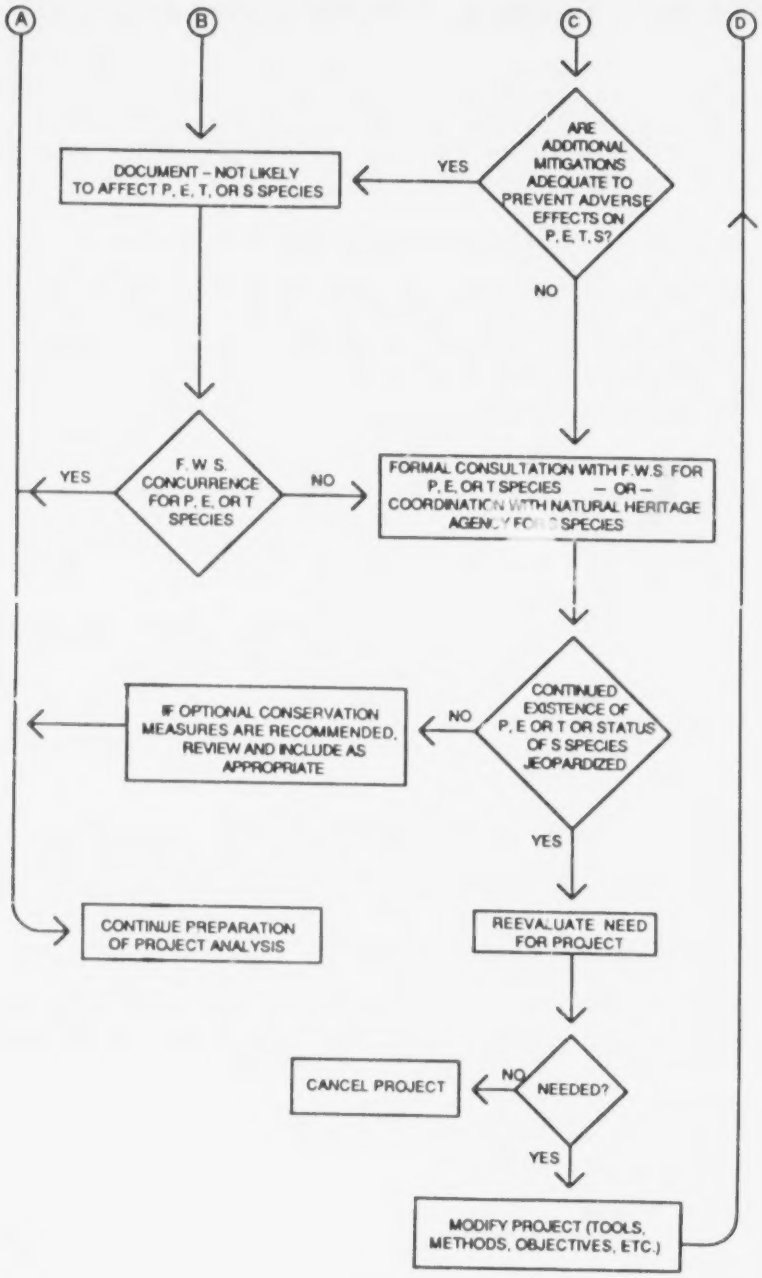

VEGETATION MANAGEMENT PROJECT PROPOSED
BIOLOGICAL EVALUATION PREPARED AS PART OF A SITE SPECIFIC ENVIRONMENTAL ANALYSIS (EIS OR EA). REQUIRES INFORMAL CONSULTATION WITH F. W. S. FOR P, E, OR T SPECIES – OR – WITH NATURAL HERITAGE SOCIETY FOR S SPECIES
PREPARE ADEQUATE INVENTORY
P, E, T, OR S SPECIES KNOWN, LIKELY TO OCCUR, OR HABITAT NEEDED FOR RECOVERY
NO
ASSESS ADEQUACY OF EXISTING INVENTORIES BASED ON LIKELIHOOD OF OCCURRENCE VS. LIKELIHOOD OF ADVERSE EFFECTS FROM PROJECT
EXISTING INVENTORIES ADEQUATE ?
NO
YES
YES
DOCUMENT – NO EFFECT ON P, E, T, OR S SPECIES
EVALUATE EFFECTIVENESS OF MITIGATIONS REQUIRED BY APPROPRIATE EIS AND FOREST PLAN
ARE MITIGATIONS ADEQUATE TO PREVENT ADVERSE EFFECTS ON P, E, T, S ?
YES
NO
DEVELOP ADDITIONAL APPROPRIATE MITIGATIONS
A
B
C
D

Figure D-1.--Site-specific environmental analysis process


A
B
C
D
ARE ADDITIONAL MITIGATIONS ADEQUATE TO PREVENT ADVERSE EFFECTS ON P, E, T, S?
YES
DOCUMENT – NOT LIKELY TO AFFECT P, E, T, OR S SPECIES
NO
F. W. S. CONCURRENCE FOR P, E, OR T SPECIES
YES
NO
FORMAL CONSULTATION WITH F.W.S. FOR P, E, OR T SPECIES – OR – COORDINATION WITH NATURAL HERITAGE AGENCY FOR S SPECIES
CONTINUED EXISTENCE OF P, E OR T OR STATUS OF S SPECIES JEOPARDIZED
NO
IF OPTIONAL CONSERVATION MEASURES ARE RECOMMENDED, REVIEW AND INCLUDE AS APPROPRIATE
YES
CONTINUE PREPARATION OF PROJECT ANALYSIS
REEVALUATE NEED FOR PROJECT
NEEDED?
NO
CANCEL PROJECT
YES
MODIFY PROJECT (TOOLS, METHODS, OBJECTIVES, ETC.)

Determination of Effect--Threatened, Endangered, Proposed Species

The actions proposed in the preferred alternative are not likely to adversely affect any threatened, endangered, or proposed species. In accordance with FSM 2670, concurrence with this determination by the USDI Fish and Wildlife Service (FWS) is recommended. The EIS, this biological evaluation, and other appendices will be forwarded to the FWS for their use.

Potential Adverse Effects--Sensitive Animals and Plants

The same general mitigation measures designed to protect threatened, endangered, and proposed species, apply equally to sensitive species except that informal coordination with appropriate state heritage trust agencies takes the place of consultation with the FWS. Table D-4 shows potential risks to sensitive animal species from herbicide application.

To protect the star-nosed mole, southern water shrew, old field mouse, masked shrew, southeastern shrew, southern pygmy shrew, southern rock vole, red-backed vole, Keen's myotis eastern small-footed bat, and Rafinesque's big-eared bat. 2,4,-D is not applied aerially within 300 feet or by ground methods within 60 feet of any known populations.

All plants listed as sensitive are protected by the same distance restrictions when applying any herbicide.

The eggs of all sensitive bird species are protected from broadcast application of kerosene, diesel oil, and herbicides containing kerosene and diesel oil by restrictions described in chapter II.

The effects of other treatments vary from beneficial to no effect to detrimental and are outlined in tables D-5 and D-6. These effects are considered in the site-specific environmental assessment and biological evaluation for each project.

Determination of Effect--Sensitive Species

The actions proposed in the preferred alternative are not likely to adversely affect any sensitive species. Informal coordination regarding this determination by appropriate state heritage trust agencies is recommended.

JAMES D. FENWOOD May 31, 1989

Table D-1.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species listed by the U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountain national forests

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Falcon, American peregrine | N | A,B,T | N | N | B | B |
| Eagle, bald | A | A,T | A | A | A | U |
| Woodpecker, red-cockaded | B,A | A,B,T | B | B | B | B |
| Squirrel, Carolina N. flying | A | A,T | A | A | A | U |
| Squirrel, Virginia N. flying | A | A,T | A | A | A | U |
| Bat, gray | U | U,T | U | U | U | U |
| Bat, Indiana | U | U,T | U | U | U | U |
| Bat, Virginia big-eared | U | U,T | U | U | U | U |
| Mussel, birdwing pearly | N | N,T | N | A | N | A |
| Mussel, dromedary pearly | N | N,T | N | A | N | A |
| Mussel, yellow-blossom Pearly | N | N,T | N | A | N | A |
| Mussel, James River spiny | N | N,T | N | A | N | A |
| Mussel, Green-blossom pearly | N | N,T | N | A | N | A |
| Mussel, tan riffle shell pearly | N | N,T | N | A | N | A |
| Mussel, fine-rayed Pigtoe pearly | N | N,T | N | A | N | A |
| Mussel, shiny pigtoe pearly | N | N,T | N | A | N | A |

Table D-1.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species listed by the U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Mussel, pink mucket | N | N,T | N | A | N | A |
| Mussel, little wing pearly | N | N,T | N | A | N | A |
| Mussel, rough pigtoe | N | N,T | N | A | N | A |
| Mussel, Cumberland monkey-face pearly | N | N,T | N | A | N | A |
| Mussel, Appalachian monkeyface pearly | N | N,T | N | A | N | A |
| Mussel, Cumberland bean pearly | N | N,T | N | A | N | A |
| Snail, noonday | N | N,T | N | A | N | A |
| Turtle, flattened musk | U | N,T | N | A | N | A |
| Chub, slender | N | A,T | A | A | A | A |
| Chub, spotfin | N | A,T | A | A | A | A |
| Madtom, smoky | N | A,T | A | A | A | A |
| Madtom, yellowfin | N | A,T | A | A | A | A |
| Log perch, conasauga | N | A,T | A | A | A | A |
| Darter, amber | N | A,T | A | A | A | A |
| Log perch, Roanoke | N | T,U | U | A | U | A |
| Blackside dace | N | T,U | U | A | U | A |

KEY

A = Adverse habitat effects
B = Beneficial habitat effects if properly applied
T = Significant risk of toxic effects
N = No effect
U = Unlikely
N/A = Not applicable; does not occur

Table D-2.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Falcon, American peregrine | No DIE*, KER* | 2,4-D, 2,4-DP, DIC, TEB, TRI | NA | NA |
| Eagle, bald | | DIE*, KER* | | |
| (Kestrel, American) | | | | |
| Woodpecker, red-cockaded | No DIE*, KER* | 2,4-D, 2,4-DP, TRI DIE*, KER* | NA | NA |
| (Woodpecker, Red-cockaded) | | | | |
| Squirrel, Carolina N. flying | | | | |
| Squirrel, Virginia N. flying | No | 2,4-D | NA | NA |
| (E. gray squirrel) | | | | |
| Bat, gray | | | | |
| Bat, Indiana | | | | |
| Bat, Virginia Big-eared | 2,4-D, 2,4-DP TRI | 2,4-D, 2,4-DP, HEX, TEB, TRI, DIC | NA | NA |
| (Bat, red) | | | | |
| Mussel, birdwing pearly | | | | |
| Mussel, dromedary pearly | | | | |
| Mussel, yellow-blossom Pearly | | | | |
| Mussel, James River spiny | NA | NA | 2,4-DE 2,4-DP | No |
| Mussel, green-blossom pearly | | | | |

*Eggs only

Table D-2.—Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Mussel, tan riffle shell pearly<br><br>Mussel, fine-rayed pigtoe pearly<br><br>Mussel, shiny pigtoe pearly<br><br>Mussel, pink mucket<br><br>Mussel, little-wing<br><br>Mussel, rough pigtoe<br><br>Mussel, Cumberland monkeyface pearly<br><br>Mussel, Appalachian monkeyface pearly<br><br>Mussel, Cumberland bean pearly<br><br>Snail, noonday<br><br>(Oyster, Virginia) | | (See previous page) | | |
| Turtle, flattened musk<br><br>(E. Box turtle) | No | 2,4-D | NA | NA |
| Chub, slender<br><br>Chub, spotfin<br><br>(Minnow, flathead) | NA | NA | 2,4-DE, 2,4-DP DIE, GLY KER, LIM | 2,4-DE DIE |
| Madtom, smoky<br><br>Madtom, yellowfin<br><br>(Hogsucker) | NA | NA | 2,4-DE 2,4-DP DIE, GLY KER, LIM TRI(E), SUL | 2,4-DE KER 2,4-DP DIE SUL, TRI(E) |

Table D-2.—Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Log perch, Conasauga (Sunfish, green) | NA<br>GLY, KER | NA<br>TRI(E) | 2,4-DE<br>TRI(E),<br>2,4-DP, DIE<br>LIM, SUL | 2,4-DE<br>2,4-DP<br>KER,DIE<br>SUL<br>GLY,<br>TRI(E) |
| Darter, amber (Bass, smallmouth) | NA | NA | 2,4-DE<br>2,4-DP<br>SUL, DIE<br>GLY(R)<br>KER, LIM,<br>TRI(E) | 2,4-DE,<br>2,4-DP,<br>KER<br>GLY(R)<br>DIE,SUL<br>TRI(E) |

KEY

TRI = Triclopyr
TRI(E) = Triclopyr ester
GLY = Glyphosate
GLY(R) = Glyphosate (Roundup)
DIC = Dicamba
HEX = Hexazinone
TEB = Tebuthiuron
DIE - Diesel Oil
KER = Kerosene
SUL = Sulfometuron
LIM = Limonene
NO = No Risk
NA = Not Applicable

Table D-3.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species listed by the U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountains national forests

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Arabis serotina | A | A | A | A | ? |
| Arenaria cumberlandensis | A | A | N/A | N/A | A |
| Betula uber | A | B | A | A | A |
| Helonias bullata | A | A | A | A | A |
| Hudsonia montana | B | B | N/A | N/A | A |
| Iliamna corei | A | B | A | A | N |
| Isotria medeoloides | ? | B | A | A | A |
| Liatris helleri | B | B | A | A | A |
| Pityopsis ruthii | NA | B | N/A | N/A | ? |
| Sarracenia oreophila | B | B | A | A | A |
| Scutellaria montana | A | A | A | A | ? |
| Solidago albopilosa | A | A | N/A | N/A | A |
| Solidago spithamaea | N | B | N/A | N/A | A |
| Trillium persistens | A | A | A | A | A |

KEY

B = Beneficial if properly applied
A = Adverse
N/A = Not applicable; does not occur
? = Unknown
N = No effect

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses).

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Hawk, Cooper's<br>Hawk, sharp shinned<br>Eagle, golden<br>Raven, common<br>(Kestrel, American) | No<br>DIE*, KER* | 2,4-D, 2,4-DP<br>DIC, TEB, TRI<br>DIE*, KER* | NA | NA |
| Flycatcher, alder<br>Shrike, loggerhead<br>Warbler, Swainson's<br>Woodpecker, red-headed<br>Wren, Bewick's<br>(Woodpecker, red-cockaded) | No<br>DIE*, KER* | 2,4-D, 2,4-DP, TRI<br>DIE*, KER* | NA | NA |
| Bittern, least<br>Egret, great<br>Osprey, American<br>(Kingfisher, belted)<br>Sparrow, Henslow's | No<br>DIE*, KER* | 2,4-D, 2,4-DP<br>DIE*, KER* | NA | NA |
| Sparrow, vesper<br>Sparrow, grasshopper<br>(Quail, Bobwhite) | No<br>DIE*, KER* | 2,4-D<br>DIE*, KER* | NA | NA |
| Fritillary, regal<br>Beetle, ground | NA | NA | NA | |

*Eggs only

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Myotis, Keen's<br>Bat, Eastern small-footed<br>Bat, Rafinesque's big-eared | 2,4-D<br>2,4-DP<br>TRI | 2,4-D<br>2,4-DP<br>TEB, TRI | NA | NA |
| (Bat, red) | | | | |
| Mouse, old-field<br>Mouse, woodland jumping<br>Mouse, meadow jumping<br>Vole, southern rock | 2,4-D | 2,4-D, 2,4-DP, DIC HEX, TEB, TRI | NA | NA |
| (Vole, meadow) | | | | |
| Cottontail rabbit, New England<br>Hare, snowshoe | No | 2,4-D, 2,4-DP HEX, TEB, TRI | NA | NA |
| (Cottontail, Eastern) | | | | |
| Skunk, Eastern spotted<br>Weasel, least | No | 2,4-D | NA | NA |
| (Fox, Eastern red) | | | | |
| Squirrel, red<br>Squirrel, fox | No | 2,4-D | NA | NA |
| (Squirrel, Eastern gray) | | | | |
| Shrew, southeastern<br>Shrew, masked<br>Shrew, southern pygmy | (See next page) | | | |

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Shrew, longtail | | | | |
| Shrew, northern water | | | | |
| Shrew, smoky | 2,4-D | 2,4-D, 2,4-DP, DIC HEX, TEB, TRI | NA | NA |
| Lemming, southern bog | | | | |
| Mole, star-nosed | | | | |
| Mole, hairy-tailed | | | | |
| (Shrew, southern short-tailed) | | | | |
| Woodrat, Eastern | No | No | NA | NA |
| (Rat, cotton) | | | | |
| Bear, black | No | No | | |
| (Bear, Black) | | | | |
| Hellbender | | | | |
| Salamander, green | | | | |
| Salamander, tiger | | | | |
| Salamander, seepage | | | | |
| Salamander, Black Mountain | | | | |
| Salander, pygmy | | | | |
| Salamander, shovelnose | No | TRI | NA | NA |
| Salamander, four-toed | | | | |
| Salamander, Thunder Ridge | | | | |
| Salamander, Cow Knob | | | | |
| Salamander, Yonahlossee | | | | |
| (Toad, woodhouse) | | | | |

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Turtle, bog | | | | |
| Turtle, map | No | 2,4-D | NA | NA |
| (Turtle, Eastern box) | | | | |
| Skink, northern coal | | | | |
| Anole, green | | | | |
| Racerunner, six-lined | | | | |
| Snake, corn | No | 2,4-D, DIC, TRI | NA | NA |
| Snake, northern pine | | | | |
| Lizard, slender glass | | | | |
| Kingsnake, scarlet | | | | |
| (Snake, hognose) | | | | |
| Darter, arrow | | | | |
| Darter, ashy | | | | |
| Darter, bluefin | | | | |
| Darter, bushytail | | | | |
| Darter, Eastern sand | | | | |
| Darter, gilt | | | | |
| Darter, greenfin | NA | NA | 2,4-DE 2,4-DP, DIE KER, SUL TRI(E) | 2,4-DE 2,4-DP DIE, KER SUL TRI(E) |
| Darter, Johnny | | | | |
| Darter, olive | | | | |
| Darter, sharphead | | | | |
| Darter, trispot | | | | |

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Darter, tangerine | | | | |
| Darter, longhead | | | | |
| Darter, Tippecanoe | (See previous page) | | | |
| Carpsucker, highfin | | | | |
| Sucker, blue | | | | |
| (Bass, small mouth) | | | | |
| Chub, blotched | | | | |
| Chub, flame | NA | NA | | |
| Chub, lined | | | | |
| Dace, redside | | | | |
| Dace, mountain redbelly | NA | NA | 2,4-DE<br>2,4-DP, DIE<br>GLY<br>KER, LIM<br>SUL<br>TRI(E) | 2,4-DE<br>2,4-DP<br>DIE, KER<br>SUL<br>TRI(E) |
| Shiner, palezone | | | | |
| Shiner, roughheaded | | | | |
| Shiner, sawfin | | | | |
| Minnow, bluenose | | | | |
| Minnow, stargazing | | | | |
| (Minnow, flathead) | | | | |
| Madtom, northern | NA | NA | 2,4-DE<br>2,4-DP<br>TRI(E)<br>GLY(R)<br>LIM, SUL | 2,4-DE<br>TRI(E)<br>KER<br>DIE<br>GLY(R)<br>SUL |
| Madtom, orange-fin | | | | |
| Sculpin, Potomac | | | | |
| (Hogsucker, northern) | | | | |

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parencheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Logperch, blotchside | NA | NA | 2,4-DE<br>2,4-DP<br>DIE, KER<br>GLY(E)<br>LIM, SUL<br>TRI(E) | 2,4-DE<br>2,4-DP<br>KER<br>TRI(E)<br>DIE,SUL |
| (Sunfish, green) | | | | |
| Lamprey, northern brook<br>Lamprey, mountain brook<br>Lamprey, American brook<br>Trout, brook | NA | NA | 2,4-DE<br>2,4-DP<br>TRI(E)<br>GLY(R)<br>KER, SUL | 2,4-DE<br>2,4-DP<br>TRI(E)<br>GLY(R)<br>DIE,KER<br>SUL |
| (Trout, brook) | | | | |
| Acornshell<br>Clubshell<br>(P. clava)<br>Clubshell<br>(P. oviforme)<br>Combshell,<br>erland<br>Elktoe<br>Elktoe, Cumberland<br>Kidneyshell, fluted<br>Long-solid<br>Mussel, Curtis pearly<br>Mussel, rayed bean<br>Mussel, spectacle<br>case | NA | NA | 2,4-DE<br>2,4-DP | No |

Table D-4.--Chemicals posing potential significant risk (in the absence of mitigation measures) to animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests. Determination of risk based on risk calculated for most-closely related representative species from risk assessment (shown in parentheses) (continued)

Note: Information given within each block applies to all species listed within that block.

| Common Name | Broadcast Herbicide (normal rate) | Broadcast Herbicide (extreme rate) | Accident (5-gal. spill) | Accident (100-gal.) spill |
|---|---|---|---|---|
| Mussel, oyster | | | | |
| Snuffbox | (See previous page) | | | |
| Rabbitsfoot | | | | |
| Purple lilliput | | | | |
| (Oyster, Virginia) | | | | |
| Sturgeon, lake | | | 2,4-DE<br>2,4-DP | 2,4-DE<br>2,4-DP |
| (Pickerel, chain) | NA | NA | DIE<br>GLY(R)<br>KER<br>SUL, TRI | DIE<br>GLY(R)<br>KER<br>SUL,TRI |
| Crayfish | | | | |
| Crayfish, cave | NA | NA | DIE<br>KER | DIE<br>KER |
| (Crayfish) | | | | |

KEY

| | | | |
|---|---|---|---|
| TRI = Triclopyr | DIC = Dicamba | KER = Kerosene | NO = No Risk |
| TRI (E) = Triclopyr ester | HEX = Hexazinone | SUL = Sulfometuron | NA = Not Applicable |
| GLY = Glyphosate | TEB = Tebuthiuron | LIM = Limonene | |
| GLY(R) = Glyphosate (Roundup) | DIE - Diesel Oil | | |

Table D-5.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Coopers hawk | B | T,B | B | U | B | N |
| Sharp-shined hawk | B | T,B | B | U | B | N |
| Henslow's sparrow | A,B | T,U | U | A,B | A | A |
| Grasshopper sparrow | A,B | T,U | U | A | A,B | A |
| Golden eagle | B | T,B | B | U | B | B |
| Great egret | U | T,U | U | U | U | U |
| Common raven | N | T,N | N | N | N | N |
| Least bittern | N | T,N | N | A | N | A |
| Loggerhead shrike | A | T,B | B | A | U | N |
| Swainson's warbler | A | T,A | U | A | U | U |
| Red-headed woodpecker | B | T,N | B | B | B | U |
| Alder flycatcher | U | T,N | N | U | U | N |
| American osprey | U | T,U | U | U | U | A |
| Bewick's wern | U | T,N | N | U | N | N |
| Regal fritilliary | ? | T,N | N | ? | N | N |
| Ground beetle | ? | ? | ? | ? | ? | ? |
| Keen's myotis | U | T,U | U | U | U | U |
| Eastern small-footed myotis | U | T,U | U | U | U | U |
| Rafinesque's big-eared bat | A | T,U | U | U | U | U |
| Red-backed vole | N | T,U | N | A | A | A |
| Star-nosed mole | N | T,U | N | A | A | A |

Table D-5.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Snowshoe hare | A | T,U | B | A | B | A |
| Southern pygmy shrew | N | T,U | B | A | A | A |
| Southern rock vole | U | T,N | N | A | U | A |
| Least weasel | B | T,B | B | A | B | A |
| Woodland jumping mouse | B,A | T,A | B,A | B,A | B,A | A,B |
| Eastern woodrat | U | T,N | N | A | A | N |
| Hairy-tailed mole | N | T,U | N | A | B | A |
| Old-field mouse | B,A | T,B | B | A | A | A |
| Fox squirrel | B,A | T,B | B | A | A | N |
| Masked shrew | N | T,B | B | A | A | A |
| Longtain shrew | N | T,N | N | A | A | A |
| Smoky shrew | A | T,A | A | A | A | A |
| Southeastern shrew | A | T,B | B | A | A | A |
| Nouthern water shrew | N | T,A | A | A | A | A |
| Eastern spotted skunk | N | T,N | N | A | N | N |
| New England cottontail | B | T,B | B | A | A | A |
| Southern bog lemming | ? | T,N | N | A | U | A |
| Red squirrel | A | T,N | N | A | N | N |
| Black bear | B | A | A | A | A | A |
| Meadow jumping mouse | A,B | T,A | B,A | B,A | B,A | A,B |
| Tiger salamander | N | T,U | U | A | U | A |

Table D-5.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Green salamander | A | T,N | A | A | U | N |
| Bog turtle | ? | T,B | B | A | A | B |
| Hellbender | N | T,N | N | U | N | U |
| Seepage salamander | A | T,U | U | A | U | A |
| Black mountain salamander | A | T,A | U | A | U | A |
| Pigmy salamander | A | T,N | N | A | U | N |
| Northern coal skink | A | T,U | U | A | A | A |
| Map turtle | N | T,N | N | A | N | A |
| Four-toed salamander | A | T,N | B | A | A,B | N |
| Shovelnose salamander | N | T,N | N | A | A | N |
| Thunder ridge salamander | A | T,N | N | A | U | N |
| Cow knob salamander | A | T,N | N | A | U | N |
| Yonahlossee salamander | A | T,N | B | A | A,B | N |
| Green anole | A | T,A | A | A | A | A |
| Six-lined racerunner | A | T,A | N | A | A | A,B |
| Corn snake | U | U,T | N | A | U | U |
| Scarlet kingsnake | A | T,B | B | A | U | U |
| Slender glass lizard | A | T,B | B | A | A | A |
| Northern pine snake | U | U,T | N | A | U | U |
| Lake sturgeon | N | T,N | N | A | N | A |
| Eastern sand darter | N | T,U | U | A | U | A |
| Crayfish | N | T,U | U | A | U | A |

Table D-5.--Potential effects of vegetation management (in the absence of mitigating measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Highfin carpsucker | N | T,U | U | A | U | A |
| Redside dace | N | T,U | U | A | U | A |
| Potomac sculpin | N | T,U | U | A | U | A |
| Blue sucker | N | T,U | U | A | U | A |
| Sharphead darter | N | T,U | U | A | U | A |
| Johnny darter | N | T,U | U | A | U | A |
| Duskytail darter | N | T,U | U | A | U | A |
| Greenfin darter | N | T,U | U | A | U | A |
| Ashy darter | N | T,U | U | A | U | A |
| Blueside darter | N | T,U | U | A | U | A |
| Arrow darter | N | T,U | U | A | U | A |
| Trispot darter | N | T,U | U | A | U | A |
| Tippecanoe darter | N | T,U | U | A | U | A |
| Flame chub | N | T,U | U | A | U | A |
| Blotched chub | N | T,U | U | A | U | A |
| Lined chub | N | T,U | U | A | U | A |
| Northern brook lamprey | N | T,U | U | A | U | A |
| Mountain brook lamprey | N | T,U | U | A | U | A |
| American brook lamprey | N | T,U | U | A | U | A |
| Roughheaded shiner | N | T,U | U | A | U | A |
| Palezone shiner | N | T,U | U | A | U | A |
| Sawfin shiner | N | T,U | U | A | U | A |
| Bluenose minnow | N | T,U | U | A | U | A |

Table D-5.—Potential effects of vegetation management (in the absence of mitigation measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Orange-fin madtom | N | T,U | U | A | U | A |
| Northern madtom | N | T,U | U | A | U | A |
| Cave crayfish | N | T,U | U | A | U | A |
| Tangerine darter | N | T,U | U | A | U | A |
| Blotchside logperch | N | T,U | U | A | U | A |
| Gilt darter | N | T,U | U | A | U | A |
| Longhead darter | N | T,U | U | A | U | A |
| Olive darter | N | T,U | U | A | U | A |
| Stargazing minnow | N | T,U | U | A | U | A |
| Mountain redbelly dace | N | T,U | U | A | U | A |
| Brook trout | N | T,U | U | A | U | A |
| Southern cavefish | N | T,U | U | A | U | A |
| Cumberland elktoe | N | T,N | N | A | N | A |
| Elktoe | N | T,N | N | A | N | A |
| Spectacle case mussel | N | T,N | N | A | N | A |
| Oyster mussel | N | T,N | N | A | N | A |
| Curtis pearly mussel | N | T,N | N | A | N | A |
| Cumberland combshell | N | T,N | N | A | N | A |
| Acorn shell | N | T,N | N | A | N | A |
| Snuffbox | N | T,N | N | A | N | A |
| Long-solid | N | T,N | N | A | N | A |

Table D-5.—Potential effects of vegetation management (in the absence of mitigation measures) on animal species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Common Name | Prescribed Fire | Herbicide | Manual | Soil Disturbing Mechanical | Mechanical | Grazing |
|---|---|---|---|---|---|---|
| Clubshell (clava) | N | T,N | N | A | N | A |
| Clubshell (oviforme) | N | T,N | N | A | N | A |
| Fluted kidneyshell | N | T,N | N | A | N | A |
| Rabbitsfoot | N | T,N | N | A | N | A |
| Purple lilliput | N | T,N | N | A | N | A |
| Rayed bean mussel | N | T,N | N | A | N | A |

KEY

A = Adverse habitat effects
B = Beneficial habitat effects if properly applied
T = Significant risk of toxic effects
U = Unlikely
N/A = Not applicable; does not occur KEY
N = None
? = Unknown

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Abies fraseri | A | U | A | NA | N |
| Acer saccharum ssp. leucoderme | ? | ? | ? | ? | ? |
| Aconitum reclinatum | ? | ? | ? | ? | ? |
| Aconitum uncinatum | ? | ? | ? | ? | ? |
| Adlumia fungosa | B | B | A | B | N |
| Agastache scrophulariaefolia | ? | B | ? | B | ? |
| Agrostis borealis var. americana | A | ? | A | ? | A |
| Alnus crispa | A | A,B | A | A,B | A |
| Arenaria groenlandica | A | A | A | A | ? |
| Arethusa bulbosa | A | B | A | B | B |
| Asplenium heteroresiliens | ? | A | A | A | ? |
| Asplenium monanthes | A | A | A | A | A |
| Asplenium resiliens | A | N | U | N | U |
| Aster ericoides | B | ? | ? | A | A |
| Aster crenatioloba | ? | ? | ? | ? | ? |
| Aster schistosus | A | A | A | A | A |
| Betula papyrifera var. cordifolia | A | A | B | A | A |
| Botrychium alabamense | ? | ? | ? | ? | ? |
| Botrychium matricariaefolium | ? | ? | ? | ? | ? |
| Boykinia aconitifolia | ? | ? | ? | ? | ? |
| Bryocromia undersonni | ? | ? | ? | ? | ? |

Table D-6.—Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Buckleya distichophylla | A | B | A | A | A |
| Calamagrostis cinnoides | ? | ? | N/A | N/A | ? |
| Calopogon tuberosus | ? | N/A | N/A | N/A | A |
| Caltha palustris | ? | B | A | B | A |
| Calycanthus floridus | A | B | A | B | A |
| Cardamine clematitis | N | A | A | A | A |
| Cardamine flagellifera | N | A | A | A | A |
| Cardamine rotundifolia | N | A | A | A | A |
| Carex aenea | ? | B | A | B | B |
| Carex amplisquama | A | B | A | A | A |
| Carex barratti | ? | ? | N/A | N/A | ? |
| Carex biltmoreana | B | B | A | A | A |
| Carex joorii | A | ? | A | A | A |
| Carex misera | A | A | A | A | A |
| Carex muricata var. ruthii | A | A,B | A | A | A |
| Carex pedunculata | ? | ? | ? | ? | ? |
| Carex purpurifera | A | A,B | A | A | A |
| Carex roanensis | A | A | A | A | A |
| Carex scabrata | A | A | A | A | A |
| Carex trisperma | A | ? | N/A | N/A | A |
| Carex woodii | ? | ? | ? | ? | ? |
| Castanea pumila | A | B | A | B | B |
| Ceanothus herbaceus | A | ? | N/A | N/A | ? |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant classified by Forest Service as sensitive species occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Chrysogonum virginianum | ? | ? | A | A | A |
| Circae alpina | A | A | A | A | A |
| Cladrastis kentuckea | ? | ? | N/A | N/A | ? |
| Cleistes divaricata | B | B | A | A | ? |
| Clematis addisonii | A | B,A | N/A | N/A | N/A |
| Clematis glaucophylla | ? | ? | ? | ? | ? |
| Clematis viticaulis | A | B | A | ? | A |
| Clintonia borealis | A | A | A | A | A |
| Coeloglossum viride var. virescens | ? | ? | ? | ? | ? |
| Comptonia peregrina | A | B | A | B | A |
| Conradina verticillata | N | B | N | A | ? |
| Corallorphiza maculata | A | ? | A | A | A |
| Coreopsis latifolia | A | N | A | A | A |
| Cornus canadensis | ? | A | A | A | ? |
| Cymophyllus fraseri | A | A | A | A | A |
| Cypripedium acaule | A | B | A | A | ? |
| Cypripedium pubescens | A | B | A | A | ? |
| Cypripedium kentuckiense | A | B | A | A | ? |
| Cypripedium parviflorum | A | A | A | A | A |
| Cypripedium reginae | ? | B | A | B | A |
| Cyperus dentatus | ? | ? | ? | ? | ? |
| Cystopteris tennesseensis | ? | N | A | A | ? |
| Dalibarda repens | A | A | A | A | A |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Diervilla lonicera | B | B | A | B | A |
| Diervilla sessilifolia var. rivularis | B | B | A | B | A |
| Diphylleia cymosa | A | B | U | N | U |
| Disporum maculatum | ? | ? | A | A | A |
| Draba ramosissima | ? | B | A | B | A |
| Dryopteris carthusiana | ? | ? | ? | ? | ? |
| Dryopteris celsa | A | A,B | A | A | A |
| Dryopteris cristata | N/A | ? | N/A | N/A | ? |
| Echinacea laevigata | A | B | A | B | A |
| Epilobium angustifolium | B | B | A | B | B/A |
| Epilobium ciliatum | N/A | ? | N/A | N/A | A |
| Equisetum sylvaticum | A | ? | A | A | A |
| Erigeron pulchellus var. brauniae | A | ? | A | A | ? |
| Euonymous atropurpureus | A | ? | A | A | ? |
| Euonymus obovatus | ? | ? | ? | ? | ? |
| Eupatorium luciae-brauniae | A | A | A | A | ? |
| Euphorbia purpurea | A | A | A | A | A |
| Faenidia montana | A | A | A | A | A |
| Fothergilla major | B | B | A | B | A |
| Fuirena squarrosa | ? | ? | ? | ? | ? |
| Gaylussacia brachycera | ? | ? | ? | ? | ? |
| Gentiana alba | ? | B | A | B | ? |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Gentiana austromontana | ? | B | A | B | A |
| Gentiana crinita | A | B | B | B | ? |
| Gentiana saponara | B | B | A | A | ? |
| Geum geniculatum | A | A | N/A | A | A |
| Geum radiatum | A | A | A | A | A |
| Glyceria nubigena | A | A | A | A | A |
| Grammitis nimbata | U | U | U | U | U |
| Gratiola pilosa | ? | ? | A | ? | ? |
| Habernaria blephariglottis var. integrilabia | ? | B | A | A | A |
| Habenaria cristata | ? | B | A | A | A |
| Habenaria flava | A | N | A | A | A |
| Habenaria orbiculata | A | A | A | A | A |
| Habenaria psycodes var. grandiflora | ? | ? | A | A | A |
| Hedyotis purpurea var. montana | B | B | N/A | B | N |
| Helenium virginicum | A | N | A | A | A |
| Helianthus atrorubens | ? | ? | ? | ? | ? |
| Helianthus glaucophyllus | N/A? | A,B | A | A,B | A |
| Helianthus silphoides | ? | ? | ? | ? | ? |
| Heracleum maximum | ? | B | A | B | A |
| Heuchera alba | ? | ? | ? | ? | ? |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Heuchera longiflora var. aceroide | A | B | A,N/A | A,N/A | A,N/A |
| Hexastylis contracta | A | A | A | A | A |
| Hexastylis virginica | ? | ? | ? | ? | ? |
| Hydrastis canadensis | A | A | A | A | A |
| Hydrophyllum virginianum | A | B | A | A | A |
| Hypericum graveolens | ? | B | A | B | A |
| Hypericum michellianum | B | B | A | B | A |
| Isoetes macrospora | A | A | A | A | A |
| Isotria verticillata | ? | ? | ? | ? | ? |
| Juncus gymnocarpus | A | N | A | A | A |
| Juncus trifidus sp. carolinianus | U | U | U | U | U |
| Kalmia angustifolia | ? | ? | ? | ? | ? |
| Lathyrus palustris | ? | ? | ? | ? | ? |
| Leiophyllum buxifolium | ? | ? | N/A | N/A | N/A |
| Listeria australis | ? | ? | ? | ? | ? |
| Liatris microcephla | B | B | A | B,A | B,A |
| Lilium canadense | B | B | A | B | A |
| Lilium grayi | B | B | A | B | A |
| Lilium philadelphicum | ? | ? | ? | ? | ? |
| Listera smallii | ? | ? | A | ? | A |
| Lobelia amoena | B | B | A | B | A |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Lobelia nuttallii | ? | B | N/A | N/A | A |
| Lonicera canadensis | ? | ? | ? | ? | ? |
| Lonicera dioica | ? | ? | ? | ? | ? |
| Lycopodium clavatum | ? | A | A | A | A |
| Lycopodium porophilum | A | A | N/A | N/A | N/A |
| Lycopodium selago | A | B | A | B | A |
| Lycopodium tristachyum | ? | ? | ? | ? | ? |
| Lysimachia fraseri | A | B | A | B | A |
| Lysimachia terrestris | A | ? | N/A | N/A | A |
| Magnolia virginiana | ? | ? | N/A | N/A | ? |
| Maianthemum canadense | A | A | A | A | A |
| Marshallia grandiflora | ? | ? | N/A | N/A | A |
| Melampyron lineare | B | B | ? | B | B |
| Meehania coordata | A,B | A | A | A | A |
| Melanthium hybridum | ? | B | A | ? | A |
| Menziesia pilosa | B | B | A | B | B |
| Monarda punctata | ? | B | A | B | ? |
| Monotropsis odorata | B | B | A | A | A |
| Myriophyllum laxum | ? | ? | A | ? | ? |
| Nemopanthus collinus | ? | B | A | B | B |
| Nestronia umbellula | N | N | A | A | A |
| Oenothera perennis | B | B | A | B | ? |
| Orontium aquaticum | ? | ? | N/A | N/A | A |

Table D-6.—Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Oryzopsis racemosa | ? | ? | ? | ? | ? |
| Osmunda ruggii | A | A | A | A | A |
| Pachysandra procumbens | ? | ? | ? | ? | ? |
| Panax quinquefolius | A | N | A | A | U |
| Panicum hemitomon | A | ? | A | A | A |
| Parnassia asarifolia | A | B | A | B | U |
| Parnassia grandifolia | A | B | A | B | U |
| Paronychia argyrocoma | A | A | A | A | N |
| Paxistima canbyi | A | A | N/A | N/A | N/A |
| Plantago cordata | N/A | A | A | N/A | A |
| Poa palustris | ? | B | A | A | ? |
| Poa saltuensis | B | B | A | B | A |
| Podostemum ceratophyllum | ? | N | A | N | A |
| Polemonium reptans var. villosm | ? | B | ? | B | ? |
| Polygala nutallii | A | A | A | A | A |
| Polygala polygama | B | A | A | A | A |
| Polygonum cilinode | B | B | ? | ? | A |
| Potamogeton amplifolius | A | A | A | A | A |
| Potamogeton ephihydrus | A | N | A | A | A |
| Potamogeton tennesseenis | A | A | A | A | A |
| Potentilla tridentata | B | B | A | ? | ? |
| Prenanthes roanensis | B | B | A | B | A |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Prunus virginiana | A | B | A | A | A |
| Pycnanthemum curvipes | B | B | B | B | N/A |
| Pyrola rotundifolia var. americana | B | B | A | A | A |
| Ranunculus allegheniensis | ? | ? | ? | ? | ? |
| Rhododendron bakeri | N | B | A | A | N |
| Rudbeckia heliopsidis | A | B | A | B | A |
| Sacciolepis striata | N/A | N | N/A | N/A | ? |
| Sambucus racemosa | ? | ? | ? | ? | ? |
| Sanquisorba canadensis | ? | B | ? | ? | A |
| Sarracenia purpurea | N | N | N/A | N/A | N |
| Saxifraga caroliniana | A | A | A | A | A |
| Saxifraga careyana | A | A | A | A | A |
| Schisandra glabra | N | B | A | A | ? |
| Schlotheimia lancholia | ? | ? | ? | ? | ? |
| Schwalbea americana | B | B | A | B | A |
| Scirpus ancistrochaetus | A | ? | A | A | A |
| Scirpus cespitosus | A | A,B | A | A | A |
| Scirpus expansus | ? | A | A | A | A |
| Scutellaria ovata var. pseudoarguta | A | A | A | A | A |
| Scutellaria saxatilis | ? | ? | A | A | A |
| Sedum nevii | A,B | B | A | B,A | A |
| Sedum rosea | U | U | U | U | U |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountains national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Senecio millefolium | B | B | A | B,A | A |
| Senecio schweinitzianus | B | B | A | B | A |
| Shortia galacifolia | A | A | A | A | ? |
| Silene ovata | ? | B | A | A | A |
| Solidago lancifolia | ? | B | B | B | ? |
| Solidago roanensis | ? | B | B | B | ? |
| Solidago spathulata | A | ? | A | A | A |
| Spiraea virginiana | A | B | A | ? | ? |
| Spiranthes lucida | A | B | A | B | A |
| Sporobolus heteriepmis | B | B | A | B | A |
| Stachys clingmanii | ? | B | A | ? | ? |
| Stellaria alsine | A | ? | A | A | A |
| Stewartia malacodendron | ? | ? | A | A | ? |
| Stewartia ovata | A | B | A | B | U |
| Streptopus amplexifolius | ? | A | A | A | A |
| Streptopus roseus | A | ? | A | A | ? |
| Symplocus tinctoria | ? | ? | A | A | A |
| Synandra hispidula | A | N | A | A | A |
| Taxus canadensis | ? | ? | A | ? | ? |
| Tephrosia spicata | B | B | B | B | ? |
| Thalictrum mirabile | ? | ? | ? | ? | ? |
| Thalictrum steeleanum | ? | ? | ? | ? | ? |
| Thelypteris pilosa var. alabamensis | A | A | N/A | N/A | N/A |

Table D-6.--Potential effects of vegetation management (in the absence of mitigating measures) on plant species classified by Forest Service as sensitive occurring on Appalachian Mountain national forests (continued)

| Scientific Name | Prescribed Fire | Manual | Soil Disturbing Mechanical | Other Mechanical | Grazing |
|---|---|---|---|---|---|
| Thermopsis fraxinifolia | B | B | A | A | A |
| Thermopsis mollis | ? | B | ? | ? | ? |
| Thaspium pinnatifidum | ? | B | ? | ? | ? |
| Trichomanes boschianum | A | N | U | U | U |
| Trichomanes petersii | A | A | A | A | A |
| Trientalis borealis | B | B | A | B | A |
| Trifolium virginicum | A | A | A | A | A |
| Trillium decumbens | ? | B | A | A | A |
| Trillium discolor | ? | ? | ? | ? | ? |
| Trillium pusillum | A | A | A | A | A |
| Trillium rugelii | ? | ? | ? | ? | ? |
| Tsuga caroliniana | A | B | A | A,B | N/A |
| Vaccinium macrocarpon | A | B | A | A | A |
| Viburnum lentago | ? | ? | ? | ? | ? |
| Waldsteinia lobata | A | A,B | A | A | A |
| Woodsia scopulina | N/A | ? | N/A | N/A | N/A |
| Woodwardia virginica | A | ? | A | A | A |
| Xerophyllum asphodeloides | B | B | A | B | A |
| Zigadenus glaucus | ? | B | A | A | A |

KEY

B = Beneficial if properly applied
A = Adverse
N/A = Not applicable; does not occur
N = None
? = Unknown

# History, Uses, and Effects of Fire in the Appalachians

APPENDIX E

See Appalachian Mountains Draft EIS

# Lists of Threatened, Endangered, Proposed, and Sensitive Animal and Plant Species of the Appalachian Mountains

APPENDIX F

# APPENDIX F

## LISTS OF THREATENED, ENDANGERED, PROPOSED AND SENSITIVE ANIMAL AND PLANT SPECIES OF THE APPALACHIAN NATIONAL FORESTS

BY

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May 1989

Table F-1.--Animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountains national forests

| Common Name | Scientific Name | Habitat | Status | National Forests Classified T.E.&P |
|---|---|---|---|---|
| American peregrine falcon | Falco peregrinus anatum | Rock outcrops, water | E | GW, NC, J, C, CH, S |
| Bald eagle | Haliaeetus l. leucocephalus | Breeds near water Winters throughout the South | E | C, CH, GW S, NC, DB J |
| Red-cockaded woodpecker | Picoides borealis | Mature yellow pine stands with open understories | E | AL, DB, CH |
| Eastern cougar[1] | Felis concolor cougar | Large forested, undisturbed areas, mountains to swamps | E | NC, J, GW |
| Carolina N. flying squirrel | Glaucomas sabrinus coloratus | Spruce-fir stands | E | NC, CH |
| Virginia N. flying squirrel | Glaucomas sabrinus fuscus | Spruce-fir stands | E | GW, J |
| Gray bat | Myotis grisescens | Caves, streamside zones | E | C, NC, CH |
| Indiana bat | Myotis sodalis | Caves, streamside zones | E | C, NC, J GW, DB |
| Virginia big-eared bat | Plecotus townsendii virginanus | Caves, streamside zones | E | J, DB, GW, NC |
| James River spiny mussel | Canthyria collina | Sand & mud bottom, shallow water | P | J |
| Birdwing pearly mussel | Conradilla caelata | Riffles, shallow, fast-flowing, clean rubble, gravel, sand | E | J |
| Dromedary pearly mussel | Dromus dromas | Shallow riffles, gravel, sand, cobble bottoms; Large rivers | E | J |
| Yellow-blossom pearly mussel | Epioblasma (Dysnomia) florentina florentina | Large streams, shallow sandy-gravel bottom with rapid currents | E | J, CH |
| Green-blossom pearly mussel | Epioblasma torulosa gubernaculum | Clean, fast flowing streams, rubble, gravel, sand bottoms, riffles; headwaters | E | J |

[1]No verifiable sightings on national forest lands in recent years, but did occur historically.

Table F-1.--Animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | Status | National Forests Classified T,E,&P* |
|---|---|---|---|---|
| Tan riffle-shell pearly mussel | Epioblasma walkeri | Shallow, turbid riffles, loose rock & gravel bars, abundant water willow, small to moderate size streams | E | J, CH |
| Fine-rayed pigtoe pearly mussel | Fusconaia cuneolus | Riffles in moderate gradient, sandy to cobble bottom | E | J |
| Shiny pigtoe pearly mussel | Fusconaia edgariana | Moderate to fast-flowing streams, riffle areas, clear water | E | J |
| Pink mucket mussel | Lampsilis orbiculata | Large stream species; firm rubble, gravel, and sand substrate | E | J |
| Cracking pearly mussel | Hemistema lata | Medium rivers; gravel riffles or shoals; burrows in substrate | PE | J |
| Little-wing | Pegias fabula | Small, cool, high to moderate gradient streams | E | DB, J |
| Rough pigtoe mussel | Pleurobema plenum | Medium to large rivers; free of silt; sand and gravel substrate | E | J |
| Cumberland monkey-face pearly mussel | Quadrula intermedia | Shallow, clean, fast flowing stream; gravel and sand substrate | E | J, CH |
| Appalachian monkeyface pearly mussel | Quadrula sparsa | Silt free riffles, rubble Gravel, sand | E | J, CH |
| Cumberland bean pearly mussel | Villosa (=Micromya) travalis | Small streams and tributaries; gravel and sand substrate | E | DB |
| Noonday snail | Mesodon clarki nantahala | Cliff face of calcareous rock with available water to support a rich, mixed mesophytic forest | T | NC |
| Flattened musk turtle | Sternotherus depressus | Large creeks, small rivers with vegetated shallows, submerged rocks with crevices, or boulders | T | AL |



Table F-1.--Animal species listed by U. S. Fish and Wildlife Service as endangered, threatened, or proposed occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | Status | National Forests Classified T,E,&P* |
|---|---|---|---|---|
| Slender chub | Hybopsis cahni | Moderate to large, warm rivers, bars & shoals of fine to medium gravel in moderate to swift currents | T | J |
| Spotfin chub | Hybopsis monacha | Moderate to swift current, large rivers, large bars & beds of small to medium size gravel | T | J, NC, CH |
| Smoky madtom | Noturus baileyi | Moderate current, pools, flat rubble | E | CH |
| Yellowfin madtom | Noturus flavipinnis | Medium size streams, warm, not silty, moderate gradient, pools, flat rubble | T | J, CH |
| Conasauga log perch | Percina jenkinsi | Deep, moderate to swift currents, clear water, cobble, gravel, sand & Podostemon | E | CH |
| Amber darter | Percina antesella | Gentle riffles over sand, gravel & cobble, Podostemon | E | CH |
| Roanoka logperch | Percina rex | Medium sized, warm, clear streams; riffles, pools and runs | PE | J |
| Blackside dance | Phoxinus cumberlandensis | Small to medium streams; shallow to moderate deep pools with good cover | T | CB |

*Key for national forests:

GW - George Washington
C - Chattahoochee
DB - Daniel Boone
CH - Cherokee
J - Jefferson
S - Sumter
NC - North Carolina
AL - Alabama



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Table F-2.--Plant species listed by U. S. Fish and Wildlife Service as threatened, endangered, or proposed occurring on Appalachian Mountains national forests

| Common Name | Scientific Name | Habitat | Status | National Forests Classified T,E,&P* |
|---|---|---|---|---|
| Shale barren rockcress | Arabis serotina | Shale barrens | PE | GW |
| Cumberland sandwort | Arenaria cumberlandensis | Moist sandstone ledges and overhangs; "rockhouse" plant | E | DB |
| Virginia roundleaf birch | Betula uber | Known from one rocky, gravelly or sandy alluvium site on Cressy Creek in Smyth County, VA | E | J |
| Swamp pink | Helonias bullata | Bogs | T | NC, GW, C |
| Mountain golden-heather | Hudsonia montana | Leiophyllum dominated shrub balds on exposed quartzite ledges | T | NC |
| Peter's mountain[1] mallow | Iliamna corei | Open, oak-hickory, Virginia pine, pitch pine with hardwood undersory | E | J |
| Small whorled pogonia | Isotria medeoloides | Open, dry deciduous woods with acid soil | E | C, NC, S, GW |
| Heller's blazingstar | Liatris helleri | Ledges and rocky woods | T | NC |
| Ruth's golden aster | Pityopsis ruthii | Soil-filled cracks of phyllite boulders in/and adjacent to the Ocoee & Hiwassee Rivers | E | CH |
| Green pitcher plant | Sarracenia oreophila | Wet, sphagnous sites, seepy depressions, hillside bogs, stream and river banks. | E | C |
| Large-flowered skullcap | Scutellaria montana | Rocky ravine-slopes and stream bottoms with gravelly fine sandy loams | E | C |
| White-haired goldenrod | Solidago albophilosa | Sandy soil of sandstone rockhouse walls and floors | T | DB |
| Blue Ridge goldenrod | Solidago spithamaea | Elevations 4,600' + in full sun in crevices of granite outcrops | T | CH, NC |

[1]Not known on national forest lands but reported as occurring nearby on private land.



Table F-2.--Plant species listed by U. S. Fish and Wildlife Service as threatened, endangered, or proposed occurring on Appalachian Mountains national forests

| Common Name | Scientific Name | Habitat | Status | National Forests Classified T,E,&P* |
|---|---|---|---|---|
| Persistent trillium | Trillium persistens | Acidic, humidified sands on steep, boundery slopes | E | C |

*Key for national forests:

GW - George Washington
C - Chattahoochee
DB - Daniel Boone
CH - Cherokee
J - Jefferson
S - Sumter
NC - North Carolina
AL - Alabama

Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Cooper's hawk | Accipiter cooperii | Deciduous forest | GW, J |
| Sharp-shinned hawk | Accipiter striatus | Woodlands and edges | CH, J |
| Henslow's sparrow | Ammodramus henslowii | Meadows, marshy openings in woods, dense ground cover | DB |
| Grasshopper sparrow | Ammodramus savannarum | Meadows, dry fields, prairies | CH |
| Golden eagle | Aquila chrysaetos | Woods, mountains & balds | C, GW, J |
| Great egret | Casmerodius albus | Streams, ponds, marshes; fresh or salt water | CH |
| Common raven | Corvus corvax | Mountainous rock ledges & conifers for nesting | C, CH |
| Alder flycatcher | Empidonax alnorum | Low bushes in wet areas, streamsides near woods | J |
| Least bittern | Ixobrychus epilis | Marsh area- often with cattails | DB |
| Loggerhead shrike | Lanius ludouicianus | Open area with thickets and hedges | GW, J |
| Swainson's warbler | Limnothlypis swainsonii | Rhododendron hillsides, bottom-lands or swamps up to 3,000 ft. | CH |
| Red-headed woodpecker | Melanerpes erythrocephalus | Orchards, roadsides, farming country, open woods | CH |
| American osprey | Pandion haliaetus | Near water | C CH |
| Vesper sparrow | Pooecetes gramineus | Upland fields, pastures, fences | CH |
| Bewick's wren | Thryomanes bewickii | Gardens, farms, woodpiles, thickets & woodlands | GW, CH |
| Regal fritilliary | Speyera idolia | Moist second-growth hardwoods along Shenandoah River | GW |
| Ground beetle | Sphaeroderus shaumi ssp | Moist areas at higher altitudes, Boreal Mountains | J |



Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Keen's myotis | Myotis keenii | Heavy forest - night- caves, mines,-day- buildings or hollow trees | DB, GW |
| Eastern small-footed bat | Myotis leibii | Hemlock forests, rock crevices, caves, mines or buildings | GW, DB, J |
| Rafinesque's big-eared bat | Plecotus rafinesquii | Dilapidated houses or buildings, hollow trees, cave or mine entrances near permanent water | DB, NC |
| Red-backed vole | Clethrionomys gapperi | Northern forest, clearings & swamps in coniferous, deciduous, or mixed forests | C |
| Star-nosed mole | Condylura cristata parva | Moist meadows, fields, swamps & woods | C, GW, J, CH, NC |
| Snowshoe hare | Lepus americanus virginianus | Mountainous swamps, forest & brush; laurel & rhododendron thickets | GW |
| Southern pygmy shrew | Microsorex hoyi winnemana | Wet & dry woods & adjacent grass clearings | C, GW, NC |
| Southern rock vole | Microtus chrotorrhinus | Rocky habitats of forest or field; burrows under leaf litter, rocks, logs | GW, NC |
| Least weasel | Mustela nivalis allegheniensis | Open woodlands, brushy or grassy fields, marshes & cultivated fields | J |
| Woodland jumping mouse | Napaeozapus insignis | Moist, cool, deep forests and forest clearings, along lake and stream beds | CH |
| Eastern woodrat | Neotoma aloridana magister | Talus slopes, rock outcrops, bluffs, along river valleys, cliffs with boulders, crevices or caves | DB, GW, J, CH, NC |
| Hairy-tailed mole | Parascalops breweri | Well drained soil with wooded cover, lawns, golf courses to 3,000 ft | CH |

Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Old-field mouse | Peromyscus polionotus | Sandy, fallow fields & other border habitats | S |
| Fox squirrel | Sciurus niger | Older groves of oaks with open understory & borders of openings & old house sites | C |
| Masked shrew | Sorex c. cinereus | Moist, deciduous, coniferous or mixed forest with moss-covered rocks, logs & stumps, & leaf litter | C, CH |
| Longtail shrew | Sorex d. dispar | Crevices in cliffs, rocky slopes & cool, moist forests with moss-covered rocks & logs | GW, J, CH, NC |
| Smoky shrew | Sorex fumeus | Damp, shady forests; deep moss, leaf litter, and rotting logs | CH |
| Southeastern shrew | Sores l. longirostris | Cool, open fields & woods, grassy edges of ponds & bogs | C, GW, J, CH |
| Northern water shrew | Sorex palustris punctulatus | Bogs, edges of streams, ponds & lakes | GW, C, NC, CH |
| Eastern spotted skunk | Spilogate putorius | Open forests with rock outcrops; Also around farmyards & buildings | DB |
| New England cottontail | Sylvilagus transitionalis | Higher elevation areas of thick cover of mountain laurel, rhododendron, blueberry, & conifers. Prefers young stands | C, GW, J NC |
| Southern bog lemming | Synaptomys cooperi helalete | Bogs and meadows with thick vegetation | CH |
| Red squirrel | Tamiasciurus hudsonicus | Prefers evergreen forest, especially spruce & hemlock; does occur in deciduous forest | C |
| Black bear | Ursus americanus | Extensive, rugged country with dense thickets, rock outcrops, mixed evergreen & deciduous forest, sufficient dens, minimum human contact | C, S, CH |



Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Meadow jumping mouse | Zapus hudsonius | Mesic areas, grassy lowlands along streams and lakes | CH |
| Tiger salamander | Ambystoma tigrinum | Ponds | GW |
| Green salamander | Aneides aeneus | Damp rock crevices in cliffs, occassionally arboreal | J, DB, NC |
| Bog turtle | Clemmys muhlenbergi | Sphagnum bogs, swamps, slow-moving meadow streams with muddy bottoms | J, C, NC |
| Hellbender | Cryptobrancmus alleganiensis | Rivers and lakes, streams with rocks and logs | NC, DB, CH |
| Seepage salamander | Desmognathus aeneus | Moist hardwood or mixed forests near wet places | AL |
| Black mountain salamander | Desmognathus welteri | Higher elevations; under stones in or near brooks, springs, and roadside ditches in wooded areas | CH |
| Pigmy salamander | Desmognathus wrighti | Beneath rotting wood, arboreal at night | J |
| Northern coal skink | Eumeles anthracinus anthracinus | Humid, wooded hillsides and bluffs near springs | DB |
| Map turtle | Graptemys geographica | Large bodies of water (rivers & lakes) | J |
| Four-toed salamander | Hemidactylium scutatum | Under logs, stones, leaf litter, moss, near ponds, swamps, or bogs | CH |
| Shovelnose salamander | Leurognathus marmoratus | Large or medium mountain brooks with many stones | J |
| Thunder Ridge salamander | Plethodon nettingi hubrichti | Moist shaded ravines in spruce forests about 3,550 ft. | J |
| Cow Knob salamander | Plethodon punctatus | High elevations of valley & ridge province | GW |
| Yonahlossee salamander | Plethodon yonahlossee | Forest litter | J |

Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Green anole | Anolis carolinensis | Wooded areas or close to human dwellings, trees, bushes, fence posts; juveniles on ground | CH |
| Six-lined racerunner | Cnemidophorus sexlineatus | Up to 2,000 ft. prefers dry regions flat or hilly; sandy or rocky; short grass, thin woods, roadsides | CH |
| Corn snake | Elaphe guttata | Woods, wood edges, cornfields, outbuildings, roadsides, prairies, plains, mixed terrain, towns. | DB |
| Scarlet kingsnake | Lampropeltis triangulum elapsoides | Fields, open woods, river bluffs, rocky hillsides, priaries,pine barren bogs, sandy soil. | DB |
| Slender glass lizard | Ophisaurus attenuatus | Oak & pine woodlands, fields, and grassy areas, brush piles | DB |
| Northern pine snake | Pituophis m. melanaleucus | Sandy pine barrens, sandhills, dry mountain ridges in/near pine woods | C, GW, DB, CH |
| Sturgeon, lake | Acipenser fulvescens | Primarily benthic, in shoal areas of lakes and large rivers, usually in 5-9 m depth over mud & gravel | DB |
| Eastern sand darter | Ammocrypta apellucida | Small creeks to large rivers; shifting sand substrate | DB |
| Crayfish | Cambarus batchi | Roaring Pauncy Creek | DB |
| Highfin carpsucker | Carpiodes velifer | Clear rivers | CH |
| Dace, redside | Clinostomus elogatus | Small to med., cool, clear, rubble and gravel substrate; pools | DB |
| Potomac sculpin | Cottus girardi | Cold to warm, usually clear, small to med. streams, stony substrate with little or no slit (eleodea) | GW |



Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Blue sucker | Cycleptus elongatus | Rivers, impoundments | CH |
| Sharphead darter | Etheostoma acuticeps | Swift, shallow to moderate deep gravel & cobble riffle | J, CH |
| Johnny darter | Etheostoma nigrum susanae | Small stream with slow current; bedrock with sand & gravel substrate | DB |
| Duskytail darter | Etheostoma cantonatus | Medium to large, warm, clear streams; pools & slow runs with little silt | J, CH |
| Greenfin darter | Etheostoma chlorobranchium | Medium to large, clear, cool to warm streams; swift riffles | J |
| Ashy darter | Etheostoma cinereum | Larger streams & rivers preferring boulders & undercut banks; mild current | DB |
| Blueside darter | Etheostoma jessiae | Small to mod. sized creeks with sand and gravel substrate; pools and riffles | J |
| Finescale saddled darter | Etheostoma osburni | Unavailable | J |
| Arrow darter | Etheostoma sugitta spilotum | Very small head-water streams with gravel substrate; pools | DB |
| Tippecanoe darter | Etheostoma tippecanoe | Long, shallow gravel riffles | J, DB |
| Trispot darter | Etheostoma trisella | Medium sized, low gradient streams with sand/gravel substrate | C |
| Flame chub | Hemitremia flammea | Spring creeks, headwaters, gravel, sand, mud, organic debris | AL |
| Blotched chub | Hybopsis insignia | Med. to large, clear, warm streams; clean rock and gravel substrate | DB |

Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Lined chub | Hybopsis lineapunctata | Medium to large streams, low gradient | CH |
| Northern brook lamprey | Ichthyomyzon fossor | Med. sized streams; adults on gravel, ammocoetes in silt beds, sand, and organic debris | DB |
| Mountain brook lamprey | Ichthyomyzon greeleyi | Small to med. stream with swift current; sand and gravel substrate | DB |
| American brook lamprey | Lampetra appendix | Quiet waters with mud-sand bottom of small creeks and rivers | DB |
| Shiner, Roughheaded | Notropis semoerasper | Slow to moderate current, pools & back waters, medium to large streams, moderate gradient, little silt | GW |
| Palezone shiner | Notropis sp. | Small streams; sand to cobble; low silt | DB |
| Sawfin shiner | Notropis sp. | Small streams; sand to cobble; low silt | DB |
| Bluenose minnow | Notropis welaka | Deep, slow moving coastal streams, silty bottom, choked with brush & vegetation, pools | S |
| Orange-fin madtom | Noturus gilberti | Riffles & runs, medium to large streams, cool to warm-clear, large gravel to boulders | GW, J |
| Northern madtom | Noturus stigmosus | Large creeks & small rivers; shifting sand or mud substrate | DB |
| Cave crayfish | Orconectes australis | Bedrock pools in caves | DB |
| Tangerine darter | Percina aurantiaca | Medium to large streams, low to high gradient, gravel/boulder substrate | CH |
| Blotchside logperch | Percina burtoni | Slow to moderate current, clear, clean streams, gravel to boulder substrate | J, DB, CH |



Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Gilt darter | Percina evides | Mod. to small, clear streams and rivers; gravel & rocks of slow runs and riffles | DB |
| Longhead darter | Percina macrocephala | Mod. to large streams, in flowing pools, near riffles with mod. amounts of detritus. | DB, CH |
| Olive darter | Percina squamatta | Mod. to large streams; swift near boulders in main channel | DB |
| Kanawha minnow | Phenacobius teretulus | Unavailable | J |
| Stargazing minnow | Phenaxibius uranops | Medium to large streams; rocky or gravelly runs and riffles | DB |
| Mountain redbelly dace | Phoxinus oreas spp. | Small to medium streams, medium to high gradient, gravel substrate | CH |
| Brook trout | Salvelinus fontinalis | Cobble, boulder, moderate to fast current, clean, headwaters of streams | CH |
| Southern cavefish | Typhlichthys subterranus | Lentic waters; subterranean; In pools of streams at or near the water table | DB |
| Cumberland elktoe | Alasmidonta atropurpurea | Small streams with low silt | DB |
| Elktoe | Alasmidonta marginata | Small streams with good current; sand & gravel substrate; mod. silt | DB |
| Spectacle case mussel | Cumberlandia monodonta | Clean, fast flowing waters; gravel and sand substrate | J |
| Oyster mussel | Epioblasma capsaeformis | Large streams with slow riffles; mod. silt | DB, J |
| Curtis pearly mussel | Epioblasma florentina curtisi | Large streams with riffles; mod. silt | DB, J |

Table F-3.--Animal species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Cumberland combshell | Epioblasma brevidens | Large streams | DB |
| Acorn shell | Epioblasma haysiana | Silt-free habitat | DB |
| Snuffbox | Epioblasma triquetra | Med. to large streams; sand and gravel substrate; riffles | DB |
| Long-Solid | Fusconaia subrotunda | Large streams with gravel substrate and swift current | DB |
| Clubshell | Pleurobema clava | Small to large streams; gravel and mud substrate; mod. silt | DB |
| Clubshell | Pleurobema oviforme | Small to large streams; gravel and mud substrate; mod. silt | DB |
| Fluted kidneyshell | Ptychobranchus subtentum | Med. to large streams; silt and cobble substrate; mod. silt | DB |
| Rabbitsfoot | Quadrula cylindrica | Large rivers; gravel substrate; riffles | DB |
| Purple lilliput | Toxolasma lividus | Small to medium streams, low current, silt substrate | DB |
| Rayed bean mussel | Villosa fabalis | Small streams; gravel & sand substrate | J |

*Key for national forests:

C - Chattahoochee
NC - North Carolina
DB - Daniel Boone
GW - George Washington
S - Sumter
CH - Cherokee
J - Jefferson
AL - Alabama



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Fraser fir | Abies fraseri | Boreal forest & balds usually above 1500 m | J, CH |
| Chalk maple | Acer saccharum spp. leucoderme | Rocky woods | CH |
| Trailing wolfsbane | Aconitum reclinatum | Rich woods | NC |
| Monkshood | Aconitum uncinatum | Rich woods of mountains & upper piedmont | DB |
| Climbing fumatory | Adlumia fungosa | Moist coves & rock outcrops | CH, NC |
| Giant hyssop | Agastache scrophulariaefolia | Woodland broders and meadows | CH |
| Bentgrass | Agrostis borealis var. americana | Higher elevations; heath balds | CH |
| Green alder | Alnus crispa | Balds (Roan Mountain) | CH, NC |
| Shale barren rockcress | Arabis serotina | Shale barrens | GW |
| Sandwort | Arenaria cumberlandensis | Moist sandstone ledges and overhangs; "rockhouse" plant | DB |
| Mountain sandwort | Arenaria groenlandica | Siliceous rocks | CH |
| Bog rose | Arethusa bublosa | Sphagnum bogs, wet meadows & woods | NC |
| Carolina spleenwort | Asplenium heteroresiliens | Marl outcrops | NC |
| Single-sorus spleen wort | Asplenium monanthes | Shaded granite boulders | NC |
| Blackstem spleenwort | Asplenium resiliens | Limestone & marl outcrops | S |
| White heath aster | Aster ericoides | Dry open places | CH |
| False goat's beard | Astilbe crenatioloba | Rich woods and seepage slopes | CH |
| Shale barren aster | Aster schistosus | Shale barrens | GW |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Mountain paper birch | Betula papyrifera var. cordifolia | Spruce/fir forests | NC |
| Alabama grape-fern | Botrychium alabamense | Brushy woods, fields & pinelands | J |
| Matricary grape-fern | Botrychium matricariaefolium | Rich soil | CH |
| Brook saxifrage | Boykinia aconitifolia | Stream banks, meadows & seepage slopes | DB |
| Gorge moss | Bryocromia undersonni | Unavailable | NC |
| Pirate bush | Buckleya distichophylla | Stream banks, shady slopes, ridgetops in hardwood-hemlock stands on acid soils | CH, J, NC |
| Cinna-like reed grass | Calamagrostis cinnoides | Bogs and moist grounds in mountains | DB |
| Grass pink | Calopogon tuberosus | Acid bogs & meadows | DB |
| Marsh marigold | Caltha palustris | Marshes | CH |
| Sweet shrub | Calycanthus floridus | Deciduous forests & stream banks | DB |
| Mountain bittercress | Cardamine clematitis | In & along rocky streams | CH |
| Bittercress | Cardamine flagellaris | Rocky streams | CH |
| Round-leaved watercress | Cardamine rotundifolia | Springs & brooksides | CH |
| Fernald's hay sedge | Carex aenea | Grass balds | NC |
| Carex, sedge | Carex amplisquama | Dry, rocky soil | C |
| Barrat's sedge | Carex barratti | Bogs | GW |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Biltmore sedge | Carex biltmoreana | Rocky woods | NC, C |
| Cypress swamp sedge | Carex joorii | Low woods & marshes | DB |
| Wretched sedge | Carex misera | Rocky crevices & balds | CH, C, S, NC |
| Ruth's sedge | Carex muricata var. ruthii | Seepages | CH |
| Sedge | Carex pedunculata | Rich, dry woodlands | CH |
| Purple sedge | Carex purpurifera | Rich woods | C, CH, S, NC |
| Roan Mountain sedge | Carex roanensis | Open, grassy balds | CH, C |
| Sedge | Carex scabrata | Seepage slopes & springheads in rich woods | C |
| Sedge | Carex trisperma | Wet sphagnum in swampy woods or bogs above 2,500 ft. elevation | CH |
| Pretty sedge carex | Carex woodii | Dry, rich woods | C, NC |
| Chinquapin | Castanea pumila | Dry woods | DB |
| Herbaceous ceanothus | Ceanothus herbaceus | Rocky banks of rivers & major creeks | DB |
| Green and Gold | Chrysogonum virginianum | Rocky woodlands | DB, CH |
| Small enchanter's nightshade | Circae alpina | Seepages of rich woods at higher elevations | DB |
| Yellow-wood | Cladrastis kentuckea | Dry limestone bluffs & rich mesophytic woods over sandstone | DB, C |
| Rosebud orchid | Cleistes divaricata | Wet areas, meadows and woodlands | AL, DB |
| Addison's leatherflower | Clematis addisonii | Unavailable | J |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Leather flower | Clematis glaucophylla | Rich woods | DB |
| Grape-stemmed leather-flower | Clematis viticaulis | Shale barrens & sparse scrubby oak-pine woods on shale | GW |
| Clinton's lily | Clintonia borealis | Moist woods and thickets | CH |
| Long-bracted orchid | Coeloglossum viride var. virescens | Meadows, bogs; moist soils | CH |
| Sweet-fern | Comptonia peregrina | Balds, dry woods, road banks | DB, C |
| Cumberland rosemary | Conradina verticillata | Rocky river bars | DB |
| Spotted coral-root | Corallorphiza maculata | Rich decaying humus; upland woods along streams | CH |
| Broad-leaved tickseed | Coreopsis latifolia | Rich, moist woods | CH, NC, C |
| Dwarf dogwood | Cornus canadensis | Damp, cool woods at high elevations | GW |
| Fraser's sedge | Cymophyllus fraseri | Rich woods | C, CH, DB J |
| Toothed galingale | Cyperus dentatus | Low sandy areas | CH |
| Pink lady's slipper | Cypripedium acaule | Bogs & dry, acid pine woodlands | AL, C |
| Yellow lady's slipper | Cypripedium calceolus var. pubescens | Wooded slopes | AL, C |
| Kentucky lady's slipper | Cypripedium kentuckiense | Forest, near streams, seeps | DB |
| Small yellow lady's slipper | Cypripedium parviflorum | Bogs, mossy swamps and woods | DB, C |
| Showy lady's slipper | Cypripedium reginae | Swamps & mossy wooded slopes | GW, CH |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Tennessee bladder fern | Cystopteris tennesseensis | Marl outcrops | NC |
| False violet | Dalibarda repens | Mossy bogs | NC |
| Northern bush-honeysuckle | Diervilla lonicera | Woodlands & rock bluffs | CH |
| Mountain bush-honeysuckle | Diervilla sessilifolia var. rivularis | Woodlands & bluffs | CH |
| Umbrella leaf | Diphylleia cymosa | Moist coves, seepage slopes, mixed deciduous forests | J, S |
| Spotted or nodding mandarin | Disporum maculatum | Moist, wooded slopes & coves | J, NC |
| Branching whitlow grass | Draba ramosissima | Limestone | CH, NC |
| Spinulose wood-fern | Dryopteris carthusiana | Rich woods and rocky banks | CH |
| Log fern | Dryopteris celsa | Shady seepage slopes of loamy valleys & swamps | CH, C |
| Crested shield-fern | Dryopteris cristata | Bogs, marshes, swamps | CH |
| Smooth coneflower | Echinacea laevigata | Meadows, woodlands with basic or circumneutral soils | C, S, J |
| Fireweed | Epilobium angustifolium | Burned areas of high elevations | CH |
| Willow-herb | Epilobium ciliatum | Bogs | CH |
| Woodland horsetail | Equisetum sylvaticum | Damp, shady areas | GW |
| Lucy Braun's robin plantain | Erigeron pulchellus var. brauniae | Thickets and moist banks; rich wooded slopes and coves | DB |
| Wahoo | Euonymous atropurpureus | Near streams or wet areas | AL |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Running strawberry-bush | Euonymus obovatus | Moist hardwood forests, coves and stream banks | CH |
| Lucy Braun's white snakeroot | Eupatorium luciae-brauniae | Mesophytic forest under overhangs or in rockhouses. | DB |
| Glade spurge | Euphorbia purpurea | Low woodlands | NC |
| Witch-alder | Fothergilla major | Dry woods & balds | CH |
| Umbrella-grass | Fuirena squarrosa | Marshes, ditches, and savannahs | CH |
| Box huckleberry | Gaylussacia Brachycera | Sandy woods | J |
| Yellow gentian | Gentiana alba | Moist meadows | DB |
| Appalachian gentian | Gentiana austromontana | Balds & other high elevations | CH |
| Fringed gentian | Gentiana crinita | Seepage slopes & damp meadows | C, NC |
| Gentian | Gentiana saponara | Bogs, marshes, low woods, roadside ditches | AL |
| Bent avens | Geum geniculatum | Balds, wooded coves of high elevations | CH, NC |
| Spreading avens | Geum radiatum | Balds, high elevations | CH, NC |
| Smoky mountain manna grass | Glyceria nubigena | Seepage areas | NC |
| Dwarf polypody | Grammitis nimbata | Wet, mossy rock ledges | NC |
| Hedge hyssop | Gratiola pilosa | Marshes & moist depressions | DB |
| White fringless orchid | Habenaria blephariglottis var. integrilabia | Wet aras on/below sandstone ridgetops | CH, DB |
| Crested fringed orchid | Habenaria cristata | Bogs, low meadows, swamps | CB, C |
| Southern rein-orchid | Habenaria flava | Alluvial woods, wet meadows, marshes | NC |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Large round-leaved orchid | Habenaria orbiculata | Coniferous or hardwood forests | CH |
| Small purple-fringed orchid | Habenaria psycodes | Upland meadows, open woods, pastures and swamps | CH |
| Large purple fringed orchid | Habenaria psycodes var. grandiflora | Upland meadows, open woods, pastures and swamps | CH, C |
| Mountain bluet | Hydyotis purpurea | Moss-grass-sedge mantles on thin, moist sand of granitic outcrops, steep slopes and bluff ledges; also grass balds | NC |
| Virginia sneezewood | Helenium virginicum | Acid, damp peaty soil of open wet meadows | GW |
| Sunflower | Helianthus atrorubens | Roadsides, pastures, woodlands, old fields | DB |
| White-leaved sunflower | Helianthus glaucophyllus | Mixed deciduous woods | CH, NC |
| Helianthus silphiodes | Helianthus silphiodes | Unavailable | DB |
| Cow-parsnip | Heracleum maximum | Stream banks, meadows, roadsides | GW |
| White alumroot | Heuchera alba | High mountain areas | GW |
| Alumroot | Heuchera longiflora var. aceroides | Rich calcerous woods | CH |
| Heartleaf | Hexastylis contracta | Steep, heavily forested stream-bluffs and ravine slopes of sandstone | DB |
| Heart-leaf | Hexastylis virginica | Deciduous forests and rocky slopes | CH |
| Golden seal | Hydrastis canadensis | Rich woods | C, CH, DB NC, AL |
| John's cabbage | Hydrophyllum virginianum | Rich wooded slopes, stream banks, alluvial woods | CH |
| Mountain St. John's-wort | Hypericum graveolens | Balds & seepage slopes of high elevation | CH |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Blue ridge St. John's-wort | Hypericum mitchellianum | High elevation seepage slopes & spray areas of falls | CH |
| Large-spored quillwort | Isoetes macrospora | Margins & shores of pools, lakes, streams | CH, GW |
| Large whorled pogonia | Isotria verticillata | Moist hardwood slopes & stream margins | C |
| Coville's rush | Juncus gymnocarpus | Swampy or springy areas | CH |
| One flowered rush | Juncus trifidus sp. carolinianus | Sterile soils | NC |
| Sheep laurel | Kalmia angustifolia | Rocky woodlands or bogs | C |
| Marsh pea | Lathyrus palustris | Bottomland woods, wet thickets, stream banks & meadows | DB |
| Sand myrtle | Leiophyllum buxifolium | Rocky woods and bluffs | C |
| Blazing-Star | Liatris microcephla | Old fields, meadows, clearings | DB |
| Canada lily | Lilium canadense | Wet meadows, bogs, and balds | CH |
| Gray's lily | Lilium grayi | Balds & openings | NC, CH, J |
| Wood lily | Lilium philadelphicum | Dry woods, thickets, open barrens and glades | DB, NC |
| Kidney-leaf twayblade | Listera smallii | Rhododendron thickets, bogs or moist mountain slopes | CH, C |
| Southern lobelia | Lobelia amoena | Marshes, stream banks, wet cliffs | CH |
| Nuttall's lobelia | Lobelia nuttallii | Bogs, marshes, meadows, low woods | DB |
| American fly-honeysuckle | Lonicera canadensis | High elevation woods, moist soils | CH |
| Mountain honeysuckle | Lonicera dioica | Rocky woodlands and thickets at high elevations | CH |
| Ground pine | Lycopodium clavatum | Sandy woods; thickets; mountain bogs and slopes | C |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Rock club-moss | Lycopodium porophilum | Shady cliffs | C, NC |
| Fir clubmoss | Lycopodium selago | Rock cliffs and barrens | CH, J, C, NC |
| Ground cedar | Lycopodium tristachyum | Dry sandy woods & rocky slopes | C |
| Fraser's loose-strife | Lysimachia fraseri | Alluvial meadows | S, CH, NC |
| Swamp loosetrife | Lysimachia | Bogs, wet meadows, swamps | CH |
| Sweet bay | Magnolia virginiana | Wet areas | CH |
| Canada mayflower | Maianthemum canadense | Upland woods & thickets | DB |
| Barbara's buttons | Marshallia grandiflora | Bogs | DB |
| Cow wheat | Melampyron lineare | Open upland woods, balds, roadsides | DB |
| Meehania | Meehania coordata | Rich wooded slopes & coves | CH, NC |
| Bunch-flower | Melanthium hybridum | Mesic wooded slopes | CH |
| Minnie-bush | Menziesia pilosa | Bogs, thinly wooded slopes, and balds | CH |
| Dotted monarda | Monarda punctata | Sandy fields, sandy or rocky woods | DB |
| Sweet pine-sap | Monotropsis odorata | Mixed deciduous woods | CH, DB, NC |
| Loose water milfoil | Myriophyllum laxum | Sinks and pools | S, AL |
| Long-stalked holly | Nemopanthus collinus | Wetland areas of balds, scattered overstory | J |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Common nestronia | Nestronia umbellula | Woodlands | C, AL |
| Small sundrops | Oenothera perennis | Open fields | DB |
| Golden club | Orontium aquaticum | Bogs & acid streams | DB |
| Black-seeded rice grass | Oryzopsis racemosa | Rocky woods of mountains | DB |
| Interrupted royal fern | Osmunda ruggii | Slightly acid, sandy, moist soil in shallow ravine with dense oak-hickory overstory | J |
| Alleghany spurge | Pachysandra procumbens | Woodlands | AL |
| Ginseng | Panax quinquefolium | Rich woods | S, DB, C, CH, J, AL, NC |
| Maiden cane | Panicum hemitomon | Marshes, pools & ditches | GW |
| Grass-of-parnassus | Parnassia asarifolia | Bogs & seepage slopes | AL |
| Longleaved grass-of-parnassus | Parnassia grandifolia | Seepage areas | S |
| Silverling | Paronychia argyrocoma | Rocky balds | C, CH |
| Cliff evergreen | Paxistima canbyi | Calcereous rocks and slopes | GW, J |
| Heart-leaved plantain | Plantago cordata | Bottomlands near strems | J |
| Fowl bluegrass | Poa palustris | Moist stream banks and meadows | CH |
| Bluegrass | Poa saltuensis | Woodlands | NC |
| Riverweed | Podostemum ceratophyllum | Aquatic; on stones in shallow, usually swiftly flowing streams | DB |
| Hairy Jacob's ladder | Polemonium reptans var. villosm | Moist, deciduous woods, stream banks, and clearings | DB |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Nuttall's milkwort | Polygala nuttallii | Moist habitats; pine woodlands | DB |
| Purple milkwort | Polygala polygama | Woodlands or woodland borders | DB |
| Fringed black bindweed | Polygonum cilinode | Clearings at higher elevations | CH |
| Large-leaved pondweed | Potamogeton amplifolius | Ponds, lakes & sluggish streams | CH |
| Nuttall's pondweed | Potamogeton epihydrus | Aquatic | CH |
| Tennessee pondweed | Potamogeton tennesseenis | Aquatic | CH |
| Three-toothed cinquefoil | Potentilla tridentata | Rock crevices & balds | C, J, CH |
| Roan Mountain rattlesnake-root | Prenanthes roanensis | Wooded slopes & road banks & balds | CH, J, NC |
| Choke cherry | Prunus virginiana | Oak-hickory woods | CH |
| Mountain pimpernel | Pseudotaenidia montana | Shale-barrens on Devonian outcrops | GW |
| Mountain-mint | Pycnanthemum curvipes | Upland woods edge; open oak-hickory or oak-pine wood; shale, phyllite or granite outcrops | CH |
| Shineleaf | Pyrola rotundifolia var. americana | Upland hardwood forest | CH |
| Mountain crowfoot | Ranunculus allegheniensis | Rich woods | CH |
| Flame azalea | Rhododendron bakeri | Upland open oak-hickory pine stands | AL, NC |
| Sun-facing coneflower | Rudbeckia heliopsidis | Woodlands & meadows | S |
| Gibbous panic-grass | Sacciolepis striata | Marshes and pools | CH |
| Red-berried elderberry | Sambucus racemosa | Rocky woods | DB |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Canada burnet | Sanquisorba canadensis | Bogs & wet meadows | CH |
| Purple pitcher plant | Sarracenis purpurea | Sphagnum bogs | C |
| Carolina saxifrage | Saxifraga caroliniana | Rocky woods | NC, CH J |
| Golden-eye saxifrage | Saxifraga careyana | Moist rocks & seepage slopes | CH, NC J |
| Magnolia vine | Schisandra glabra | Rich woods | C |
| Highlands moss | Schlotheimia lancholia | Unavailable | NC |
| Chaffseed | Schwalbea americana | Sandstone flats & knobs | DB |
| Northeastern bulrush | Scirpus ancistrochaetus | Wet depressions, bogs & margins of acidic waters | GW, J |
| Deer-hair bullrush | Scirpus cespitosus | Exposed ledges at high elevations | CH |
| Woodland beakrush | Scirpus expansus | Swamps or along brooks in shade | DB |
| Heart-leaved skullcap | Scutellaria ovata var. pseudoarguta | Shale barrens & other dry soils, mostly on eastern slopes | DB |
| Rock skullcap | Scutellaria saxatilis | Low woodlands | CH |
| Nevius' stonecrop | Sedum nevii | On limestone or shale | CH, AL |
| Roseroot | Sedum rosea | Rocky cliffs of high elevations | NC |
| Divided-leaf groundsel | Senecio millefolium | Flat, rocky cliff ledges & crevices in shallow sandy soil | NC, C |
| Robbin's squaw-weed | Senecio schweinitzianus | Open grassy balds of Roan Mountain | CH, NC |
| Oconee bells | Shortia galacifolia | Rich woods on stream banks | C, NC |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Catch-fly | Silene ovata | Rich woods | CH, NC |
| Goldenrod | Solidago lancifolia | Rich woodlands and roadbanks | CH |
| Roan Mountain goldenrod | Solidago roanensis | Woodlands & road banks | DB |
| Goldenrod | Solidago spathulata | Rocky banks of rivers & major creeks | DB |
| Virginia spiraea | Spiraea virginiana | Stream banks or zones | J, NC |
| Shining ladies' tresses | Spiranthes lucida | Moist banks and damp meadows | DB, CH |
| Prairie dropseed | Sporobolus heteriepmis | Pine barrens over serpentinized olivine | NC |
| Hedge-nettle | Stachys clingmanii | Meadows, roadsides, clearings often previously disturbed by fire | CH |
| Chickweed | Stellaria alsine | Seepages | CH |
| Silky camellia | Stewartia malacodendron | Deciduous forest, low woods & creek banks | AL |
| Mountain camellia | Stewartia ovata | River bluffs, wooded stream margins | AL, S |
| White mandarin | Streptopus amplexifolius | Moist woods | CH |
| Rosy twisted-stalk | Streptopus roseus | Moist woods | C, DB, CH |
| Horse-sugar | Symplocus tinctoria | Sandy thickets, upland or alluvial woods and stream margins | CH |
| Gyandotte beauty | Synandra hispidula | Rich, mesic, wooded slopes | DB, J |
| Canada yew | Taxus canadensis | Cool, shady areas at high elevations | DB |
| Goat-Rue | Tephrosia spicata | Roadsides, open woods, clearings | DB |
| Meadow Rue | Thalictrum mirabile | Rich woods | DB |

Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Steele's meadow-rue | Thalictrum steeleanum | Alluvial soil | GW |
| Alabama streak | Thelypteris pilosa var. alabamensis | Rich, damp woods | AL |
| Bush-pea | Thermopsis fraxinifolia | Ridges & clearings | CH |
| Bush pea | Thermopsis mollis | Open woods and clearings | DB |
| Cutleaf meadow parsnip | Thaspium pinnatifidum | Hardwood forests and forest margins in limestone areas | DB |
| Bristle fern | Trichomanes boschianum | Shaded crevices & grottoes in sandy or acidic rocks | CH, S, DB NC |
| Dwarf filmy fern | Trichomanes petersii | Crevices & grottoes in acidic rocks or bases of tree trunks | NC, S, CH |
| Star-flower | Trientalis borealis | Moist woods of higher elevations | C, CH |
| Kate's mountain clover | Trifolium virginicum | Shale barren, endemic | GW, J |
| Decumbent trillium | Trillium decumbens | Rocky woods | CH |
| Mottled trillium | Trillium discolor | Wooded slopes; basic soils | NC |
| Dwarf trillium | Trillium pusillum | Alluvial woods, hardwood bottoms with high spots | GW |
| Nodding trillium | Trillium rugelii | Unavailable | CH |
| Carolina hemlock | Tsuga caroliniana | Moist soil of rocky ridges and slopes | CH |
| Large cranberry | Vaccinium macrocarpon | Bogs | GW, CH, NC |
| Nannyberry | Viburnum lentago | Rich soils of woods and stream-banks | DB |



Table F-4.--Plant species listed by Forest Service as sensitive occurring on Appalachian Mountains national forests, continued

| Common Name | Scientific Name | Habitat | National Forests Classified Sensitive* |
|---|---|---|---|
| Little spectacle case | Villosa lienosa | Unavailable | DB |
| Barren strawberry | Waldsteinia lobata | Sandy loams in acid-rocky woods on boulders or bluff ledges | S, C |
| Rocky mountain woodsia | Woodsia scopulina | Shale or sandstone cliffs | CH |
| Virginia chain-fern | Woodwardia virginica | Acid soils, bogs, thickets, and wet pinelands | CH |
| Turkey beard | Xerophyllum asphodeloides | Oak-hickory woods, usually xeric | GW, CH, C |
| White camus | Zigadenus glaucus | Upland woods | CH, J |

*Key to national forests:

J - Jefferson
CH - Cherokee
C - Chattahoochee
GW - George Washington
NC - North Carolina
AL - Alabama
DB - Daniel Boone
S - Sumter